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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

HEARINGS

BEFORE THE

COMMITTEE ON ARMED SERVICES
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON

S. 1174

AUTHORIZING APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989 FOR MILITARY ACTIVITIES OF THE DEPARTMENT OF DEFENSE, FOR MILITARY CONSTRUCTION, AND FOR DEFENSE ACTIVITIES OF THE DEPARTMENT OF ENERGY, TO PRESCRIBE PERSONNEL STRENGTHS FOR SUCH FISCAL YEARS FOR THE ARMED FORCES, AND FOR OTHER PURPOSES

PART 4

STRATEGIC FORCES AND NUCLEAR DETERRENCE

FEBRUARY 23, 26; MARCH 6, 10, 12, 19, 23, 24, 26, 31; APRIL 1, 2, 9

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DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

MONDAY, FEBRUARY 23, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

B-1B PROGRAM

The subcommittee met in open session, pursuant to notice, at 11:02 a.m. in room SD-106, Dirksen Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Bingaman, Glenn, Warner, and Wilson.

Staff present: Arnold L. Punaro, staff director; Andrew S. Effron, counsel; Robert F. Bott, John J. Hamre, and Ronald P. Kelly, professional staff members; Pamela G. Powell and Mickie J. Gordon, staff assistants.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Milton D. Beach and Donald A. Mitchell, assistants to Senator Glenn; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; and Bill Wight, assistant to Senator Warner.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order.

Gentlemen, we welcome you here this morning. On a note of levity, thank you very much for the wakeup call from the Strategic Air Command headquarters in Omaha this morning. My electricity went off and my alarm failed. I hope that you will not repeat that each and every morning, Monday morning especially, but I appreciate your particularly important efforts to come in here today during this snowstorm.

I want to congratulate the Air Force and particularly the Strategic Air Command for their wisdom in locating the headquarters of the Strategic Air Command in Nebraska, which has a subtropical climate compared with the rather strenuous winters that we have here in the Nation's Capital. While you were able to get around

this morning, many of us here had a great deal of difficulty, and we have less attendance than we had anticipated here.

I am pleased to welcome John Glenn, who probably came in a spacecraft from his home this morning.

We know that some of our colleagues are en route. The ranking minority member, Senator Thurmond, has had airplane problems. I will be introducing an opening statement from him, and in just a moment I will call on Senator Glenn for any opening comments that he might have.

The subcommittee meets for the first time this morning to begin its review of our strategic programs. The purpose of this hearing is to establish the proper perspective on the status of the B-1B program, its success and its shortcomings, future costs and in, as much as possible, open testimony. We can go into closed testimony later on if that is necessary to review improvements in Soviet air defenses that may have necessitated some possible changes in the B-1B design performance and construction in the last several months.

It is important to begin these proceedings by identifying the B-1B's place in our Nation's overall defense plan. The heart of this plan is the concept of deterrence; that is, insuring that the United States maintains a survivable nuclear force capable of retaliating should the Soviet Union ever launch a nuclear attack. This deterrence rests upon a triad of forces comprising land-based missiles, submarine-launched missiles and bombers, some of which carry cruise missiles. Each of these forces has limitations and advantages which, in combination, assure our overall survivability and credible deterrence.

Our bomber forces will rely upon the aging B-52 both as a penetrating bomber and as a cruise missile carrier until it can be modernized with the Stealth bomber in the 1990s; however, improvements in the Soviet air defenses will seriously erode the B-52s capability to penetrate targets in the Soviet Union.

As a result, the Reagan administration decided to build a fleet of 100 B-1Bs for $20.5 billion to serve as a penetrating bomber. Once the more survivable Stealth comes on line, the B-1B is intended to gradually revert to a conventional non-Soviet homeland penetrator and a carrier of cruise missiles carrying on the role of the B-52s as they begin to be retired.

The last of the B-1Bs was purchased last year in what, until recently, has been described as the best-managed strategic program that we have ever seen. Serious questions have now arisen, and challenges have been made about the effectiveness of the B-1B. Problems associated with the aircraft reliability, stability, fuel leaks, terrain-following radar and electronic countermeasures have been raised.

Earlier this month, the chairman of the House Armed Services Committee stated that it would cost $3 billion to correct deficiencies in the B-1B. Clearly we need to get at the heart of this situation and put things in the proper and current perspective.

In my view, from its inception, the importance of the B-1B as a penetrator would last for only a limited number of years given the ever-increasing capabilities of Soviet air defenses. I viewed this limited fleet of 100 bombers primarily as a bridge between the B-52s and our oncoming ATB force.

Senator Thurmond was to have been with us this morning, and he may arrive during this hearing. Senator Thurmond, the ranking minority member of this subcommittee, and I worked closely together in the Armed Services Committee for many years, and I look forward to this relationship in the future.

We also wish to welcome the other members of the subcommittee, especially Gen. Jack Chain, the Commander of the Strategic Air Command and actual operating crews of the B–1B that we are reviewing here today. I know today's hearing will be an important one, and at this time I would like to yield to Senator Glenn for any comments that he wishes to make.

Senator Glenn.

Senator GLENN. Thank you, Mr. Chairman. I have very brief comments. I congratulate you for holding this hearing, and I join you in welcoming General Randolph, General Chain and the other witnesses from SAC this morning. We appreciate your coming in this morning gentlemen.

It appears to me as well as others on the Strategic Subcommittee we need to talk about the B–1B program yet one more time, unfortunately, and to hear firsthand from the people most responsible for integrating and operating this modern strategic bomber.

There is no question in my mind we need a more capable heavy bomber to meet our strategic and, in my mind, more importantly, our conventional bomber requirements. General Randolph and I have talked about this many times, and I think my own personal view is that the Pentagon has done a lousy job in presenting the B–1B. It is not the fault of the General, but others. I feel we need a conventional bomber.

To me, the main advantage of the B–1 is its conventional warfare role. It took us a while some years ago before you fellows were out there flying the thing to really put some pressure on the Air Force to put as much emphasis on the conventional role as on the SIOP role. To me, that still is the main reason for having the airplane. It can be used in the Straits of Malacca and the Far East; it can be used anywhere—although we always put all of our emphasis on the route to Moscow.

To me, the conventional bomber role is at least as important as the SIOP mission. I hope we never get to that nuclear threshold, and that is why we need the heavy bomber.

I was reminded the other day when we had a big celebration of the 25th anniversary of my orbital flight. Someone reminded me when we were talking about this morning's hearing that the last B–52 was delivered to the Air Force the same year I made that flight, 25 years ago in 1962. So if there is any doubt about needing a new heavy bomber, Mr. Chairman, I think that sort of indicates that we do.

So it is unfortunate, therefore, that there has been and continues to be so much media and political controversy surrounding the introduction of this much-needed weapons system in spite of the fact that a whole parade of witnesses before this committee, including the Secretary of Defense, Chairman of the Joint Chiefs, Secretary of the Air Force, Air Force Chief of Staff, have all indicated that the B–1 right now is the most advanced and most capable bomber in the world today. The program remains on schedule, and suffi-

cient funds exist within the fiscal year 1981 cost ceiling to correct identified problems.

I, along with several others, have been particularly concerned about the continuing media criticism of the B–1B. Most of the criticism has been misleading and a disservice to the American taxpayer who helped pay for the B–1B. Let me give you an example.

My office received a letter on February 12, and I have a copy of it here, from Mr. Walter F. Hahn, editor-in-chief of the Strategic Review, in which he described how a statement on the B–1B by the Chief of the Air Force Systems Command was taken out of context and used on the NBC "Today Show" on February 5. The statement by General Skantz was, "Are we delivering B–1Bs today that are as capable as we had planned? Frankly, no. The B–1B is not yet as capable as we had planned." That is the statement as it was used on NBC.

His whole statement, the full context of his statement, was as follows:

> The question raised in the media and I'm sure in your minds is are we delivering B–1Bs today that are as capable as we had planned? Frankly, no. The B–1B is not yet as capable as we had planned; however—that is where they ended it on NBC. However, we are absolutely confident that as the aircraft matures, it will be, and even given its maturation problems, as it sits on alert right now at Dyess Air Force Base, the B–1B is the best strategic bomber in the world capable of meeting the threat it faces today and ready to perform its mission. The B–1B can deliver large weapon payloads over intercontinental ranges, penetrating sophisticated defenses at very low altitudes and very high speeds. The Soviets are very well aware of this.

Mr. Chairman, this paragraph was contained in the 22-page statement by General Skantz entitled "B–1B Program In Perspective" given to the National Press Club on February 4, 1987. I ask unanimous consent that the entire statement be made part of the record of this hearing.

Senator EXON. Without objection.

[The information follows:]

B–1B PROGRAM IN PERSPECTIVE

(An address to the National Press Club, February 4, 1987, by Gen. Lawrence A. Skantz, Commander, Air Force Systems Command)

Good afternoon ladies and gentlemen. It's a pleasure to have the opportunity to address this distinguished gathering.

Many of you will recall that on October first last year, I appeared before the Pentagon Press Corps to announce that the Air Force had placed the first B–1B on operational alert according to a plan laid out five years earlier. This significant milestone in our Nation's quest for a modern penetrating bomber—a quest that spans most of my 28 years in weapon system acquisition—was accomplished on schedule, but not without a certain amount of risk and a certain amount of pain.

Acquiring the B–1B, or any other weapon system for that matter, entails developing, testing and producing new technology. In any high tech endeavor, the Defense Acquisition Team faces a continuous challenge: that of managing risk, whether it be technical, cost, schedule . . . or all of the above. The B–1B, a vital element of President Reagan's Strategic Modernization Program, provides a timely lesson in the art of risk management, and we have a B–1B today thanks to a significant risk management decision made in 1981.

In the late stages of the previous administration, there was a strong consensus that the Nation needed to modernize the bomber leg of the strategic triad. Congress itself recognized this need as early as 1980 and, in the fiscal year 1981 Defense Authorization Act, directed the Secretary of Defense to develop a multirole bomber for both nuclear and conventional missions. Congress directed us to bring that bomber on line as soon as practicable, but not later than 1987. I was the commander of the

Air Force's Aeronautical Systems Division then and thus became immediately and heavily involved in the alternative studies that Congress directed beginning in the early fall of 1980. Congress told us to look at the B-1, derivatives of the B-1, derivatives of the FB-111, or a new technology bomber.

The new administration immediately picked up the challenge to implement the new bomber program. Our goal was a single new bomber which could rapidly redress a growing strategic imbalance and provide an enduring capability to penetrate Soviet defenses.

Based solely on its projected capabilities, the Advanced Technology Bomber, or ATB, easily would have been the choice in a one-bomber approach. In the spring of 1981, Secretary Weinberger, General Richard Ellis, then CINCSAC, and I discussed the bomber issue at SAC Headquarters in Omaha, Nebraska. We all recognized the dramatic potential of the ATB, but we also recognized that, first and foremost, we needed time to reduce a number of major technical risks to assure ourselves that the ATB could be successfully designed and engineered.

There was little hope of seeing the emergence of a viable ATB force before the early nineties. In the final analysis, the only way to quickly modernize the manned bomber leg was to build a limited number of highly effective B-1Bs, deploy them as rapidly as possible and, in effect, buy the time for ATB development, since the B-1B, alone, could not provide the long-term enduring penetration capability that an ATB offered.

That's the background for why this administration proposed the two-bomber program: 100 B-1Bs, for a highly-capable, near-term modernization and as a hedge against ATB technology uncertainty; and the ATB, for the long-term capability. That decision, like all major acquisition programs, carried with it the management of a significant degree of risk. For the ATB, the management focus was to attack the unknown risks in the technology to establish a firm base to ensure we could move into full-scale development and production on a confident and predictable basis. In the case of B-1B, we decided on a totally concurrent development and production program to expedite the fielding of the system and minimize the acquisition cost.

In January 1982, I signed both the B-1B development and production contracts and we began a challenging production schedule; specifically, to deliver all 100 aircraft by June 1988. Our plan was twofold: rapid development and production of 100 B-1Bs with an initial operational capability in 1986 for a cost of $20.5 billion in constant 1981 dollars; and, in parallel, long-term risk reduction, development and production of 132 ATBs to be deployed in the early 1990s. That was our plan in 1981, it remains our plan today, and it will be our plan tomorrow.

Well, where does the B-1B program stand today? We have all 100 B-1Bs on contract, we achieved the initial operational capability in September, on schedule, and to date we have delivered thirty-four aircraft, on schedule.

The major program challenge was and still is meeting the production schedule. Eighty-four percent of the $20.5 billion—which by the way is a Presidentially-certified and congressionally-imposed cost cap—is devoted to production. We currently spend $500 million per month on production. At that rate, a slip of even one month means big financial trouble. So, production demands intense and constant management attention. For example, had we elected to delay the production contract for one year past development start and hold the production rate at three aircraft per month, as opposed to four, we certainly would have reduced the overall risk associated with high concurrency. But we also would have increased the cost by about $3 to $4 billion and delayed the achievement of the full-operational capability by a year and seven months.

It's impossible to overstate how much planning and management effort went into making the four aircraft per month rate happen. We went from one aircraft per month to four aircraft per month in less than one year and achieved rate in November 1986 as planned. In fact, we delivered five aircraft in December. There was great risk. For example, final checkout and assembly was tough. To contain costs, we had to reduce checkout time from 3.5 months, for the first aircraft, to 20 davs, at rate production. And we did it. Had we not achieved this reduction in checkout time, stretchout costs could have grown by over $1 billion. Meeting rate production is a significant achievement for the over 3,000 contractors involved in the program and something in which they, and we, can and do take great pride. It is truly a great defense industry production story which I hope will be told someday.

The question raised in the media, and I'm sure on your minds, is: Are we delivering B-1Bs today that are as capable as we had planned? Frankly, no. The B-1B is not yet as capable as we had planned. However, we are absolutely confident that as the aircraft matures, it will be. Even given its maturation problems, as it sits on

alert right now at Dyess AFB, the B-1B is the best strategic bomber in the world, capable of meeting the threat it faces today, and ready to perform its mission. The B-1B can deliver large weapon payloads over intercontinental ranges, penetrating sophisticated defenses at very low altitudes and very high speeds. The Soviets are very well aware of this.

Not surprisingly, most of the problems we have experienced relate to areas where we changed the B-1A design. When we embarked on the B-1B Program, we purposely, and very wisely, incorporated new technology and design changes in selected areas to increase capability and survivability. In some of these areas, results have already been successful; in other areas, we've experienced what I characterize as development problems and delays in achieving the full capability of the system. We are finding and fixing problems in the test program which is what a test program is for. It has simply taken longer to mature the system than we had planned. Here are the facts.

One of the changes made in the design of the airframe was to increase its gross weight capability to permit it to carry cruise missiles externally in addition to internal weapons. We did this very deliberately so that when the threat increases to where the B-1B is no longer an effective penetrator, it can perform the role of a standoff cruise missile launch platform. The same thing was done with the B-52. I might add that had we built the B-1A, we would have eventually modified it to carry cruise missiles and would have also increased its gross weight to do so. Specifically, the empty weight of the B-1B was increased by about 7,000 pounds to beef up its structure to carry the added weight of cruise missiles. As a result, the weapon payload was increased from 75,000 to 125,000 pounds and its fuel capacity with maximum payload was increased by 25,000 pounds. This 82,000 pound increase in gross weight was possible because the B-1A had excess energy over that required for the low altitude, high subsonic penetration mission of the B-1B.

As so-called evidence that this gross weight capability increase is bad, some critics point out that the plane can't fly as high as a B-52 or even a 747. That's absolutely true, but I would quickly add that a B-52 or a 747 can't fly as low and as fast as a B-1B. The point is the B-1B was designed as a low, not high, altitude penetrator and was optimized for that mission with a penetration speed fifty percent greater than that of the B-52. The bottom line is that the aircraft meets the weight and range specifications we contracted for.

About a year after we signed the contracts, when we began evaluating flight test performance, we recognized that we could take advantage of the available lift at higher angles of attack, where the B-1B does not have pronounced stall warning, through the development of a stall inhibit system. Later we started developing the stability enhancement function which allows the aircraft to operate safely in regions beyond the inherent design capability. This will not only increase performance throughout the operational flight envelope, but will significantly add to our ability to operate at very high gross weight during terrain-following, thus increasing range over that specified in the contract. The contractor agreed to do the improvement within the cost baseline, though it is primarily needed for cruise missile carriage gross weight missions which are still some years away.

We wanted to have the stall inhibit system in the aircraft last September and the stability enhancement function about a year later. Regrettably, development of both has lagged. Strategic Air Command will have the stall inhibit system capability in April, and we will complete retrofit of the first 16 aircraft by the end of the year. We will begin flight test of the stability enhancement function this spring and should complete testing in early 1988.

We made another major change in the B-1A airframe to increase survivability. We reduced the radar cross section by a factor of ten over the B-1A and 100 over the B-52. We redesigned various areas of the aircraft, including the engine nacelles, using technology developed in the Stealth Program. The redesign was totally successful, with no degradation in aircraft performance.

We also incorporated a new offensive avionics suite in the B-1B. The 1960's vintage F-111 radar in the B-1A was replaced with a new, state-of-the-art derivative of the F-16 radar, and new avionics based on the B-52 developed offensive avionics system were added. The result is increased capability and unparalleled navigation and weapon delivery accuracy, with sharply reduced radar emission signature. The offensive avionics development has been a great success.

Another innovation was to use this same F-16 radar derivative not only for navigation but also for terrain following. While this approach reduces cost and the amount of electronics, it adds to the software complexity. However, software, once developed, doesn't break like hardware. Again this was another risk management decision made to balance aircraft cost, schedule, and performance. As some of you

know, development of this software proved to be a very tough integration job—which is nearly complete. However, we are late in releasing the automatic terrain following capability to the Strategic Air Command for routine training. It should be noted that all of the aircraft at Dyess AFB have had terrain-following capability for wartime use since September. We have demonstrated that the system works and have flown it repeatedly at low altitude and high speed as designed, and we will release the capability for training to the Strategic Air Command this month.

This brings me to the most ambitious development challenge we undertook in the B–1B Program: the electronic countermeasure system. We took the ECM system from the B–1A and redesigned it to incorporate lessons learned from the bomber penetrativity evaluation that was conducted after the cancellation of the B–1A production. We also improved the design to handle new threats.

That task entailed taking a system with 88 black boxes weighing over 5,000 pounds, and increasing it to 118 black boxes weighing under 5,000 pounds. This is the first totally integrated and the largest electronic countermeasure system we have ever attempted. By comparison, the latest ECM system we developed for the B–52 has 23 black boxes. Clearly this area was the greatest challenge from a program concurrency standpoint, and quite simply, development is not complete. But then, ECM development and upgrades never really end anyway!

Our ECM problems fall into two categories. First, although each of the black boxes checked out individually, they don't yet function well as a system. This is the integration problem I mentioned earlier. Secondly, electronic countermeasures are always a cat and mouse game—you have to know a great deal about the threat in order to counter it. The first thing we collect about an electronic threat is its transmitted signals. But, to effectively counter it, we need to know about, or make judgments about, the receiver, processor and logic of the radar operations. In the absence of hard intelligence, we have to make assumptions. Once we get the good information, we sometimes find that we are surprised. That's partially the case with the B–1B. Fortunately, and for that very reason, we designed the B–1B system to be very flexible and reprogrammable so that we can respond to changes in the threat. It is important to understand that the design of the ALQ–161 defensive avionics system is sound and constitutes the most flexible, robust ECM system we have ever built. There's a consensus among the experts who have examined it that it will achieve the expected performance.

The early focus in the program was on the production challenge. The AIL Division of Eaton Corporation had an excellent technical reputation, but no one had ever attempted to build such a large, complex electronic countermeasure system on an accelerated production schedule. There was also real concern that the defense industrial base could not provide the required numbers of high quality radio frequency, or "RF", components, such as high frequency traveling wave tubes, to support the program's rate production needs. Because the production contract with AIL is roughly 10 times the magnitude of the development contract, because the system worked so well in the laboratory tests, and because of the industrial base concerns that I just mentioned, our focus was properly on production. As we began flight testing the more sophisticated aspects of the system, the problems became evident—starting in February of last year.

There is no question that we have been disappointed in our ECM development progress to date. But I am equally confident that we have a good game plan to mature the system and that we will achieve the design capability. I'm confident because some of the best minds in the country, some very skeptical, have taken looks at the system. They've concluded that our recovery plan is solid and the system design is sound. I might add that there have been a number of excellent recommendations to improve the get-well plan, all of which are being implemented. A three-step maturation process lies ahead. Capability is increased with each step, beginning this summer and ending in about two years.

The last problem area I want to discuss is fuel leaks. We made no basic change in the design of the fuel containment system between the B–1A and the B–1B. The B–1 uses a design concept called "integral fuel tanks" to contain fuel in which the aircraft structure is also the "fuel tank." There are no internal bladders or tanks, only the structure. This design is used in most modern aircraft, but not as extensively as the B–1B. Why this concept instead of bladders? Bladders would decrease the range of the aircraft by 10–30 percent. That, in turn, would require a larger, more expensive aircraft to meet the range requirement. This decision, like others, was made to balance cost, schedule and technical risk.

In the fall of 1985, the B–1Bs at Dyess began to experience fuel leaks at a higher than anticipated rate. I'd add at this point that all aircraft, particularly those with integral tank designs, develop leaks. Most of the leaks, 69 percent to date, have been

what I termed in October "weeps and seeps." So far, we have experienced only two leaks that would have prevented immediate wartime use. Nevertheless, the minor leaks are a problem.

In July of last year, as I stated in October, the leaks were seriously impacting the flying operations at Dyess AFB—in other words the leaks prevented us from flying when we wanted to. Although we had taken a number of actions to correct the problem beginning in the fall of 1985, we intensified our efforts last summer and continue with monthly manufacturing audits to ensure that corrective actions are implemented. As a result, fuel leaks no longer seriously impact flying operations. That's not to say that we don't have some minor leaks, but the number of leaks is decreasing as the aircraft matures. For example, in July we were experiencing 6.25 leaks per aircraft per month; in January the rate was less than two leaks per aircraft per month. By way of comparison, the leak rate for the B-52 was still at one leak per month thirteen years after delivery of the last aircraft.

That sums up the B-1B's major problems but, since I know the media likes balanced reporting, I would also like to point out some areas which have plagued other aircraft that the B-1B has not experienced. For example, take the F-101 engine manufactured by General Electric. As far back as I can remember, new aircraft have experienced engine problems. The P-51, B-29, B-52 and our modern fighters have all had problems with engines that, in some cases, caused loss of aircraft. The B-1B hasn't had these problems. Its engine is not only meeting all specification requirements but, in fact, has a higher thrust and lower specific fuel consumption than contracted for. A second "non-problem" that comes to mind is cost. We are confident that all of the problems that I have discussed can be corrected within the $20.5 billion cost cap.

I must admit, however, that the support for the B-1B cap has been a severe disappointment. When we committed to the $20.5 billion in fiscal year 1981 dollars in late 1981, we were criticized by the Congress and GAO during the 1982-83 congressional cycle. I know, because I was the Air Force's Deputy Chief of Staff for Research, Development and Acquisition and in testimony on the Hill I was asked—point blank—when the Air Force would own up to the fact that we couldn't do the program within the cap. By 1984-85, the charge became, "you have too much money in the program," and despite our insistence that we needed the contingency funds for our high program concurrency risk, a little over $1.0 billion was removed from the program in fiscal year 1986 with the promise, "well, if you need some more later come back and ask us." Thus, to tout the fiscal year 1988 request as additional costs for the B-1B is a cheap shot.

Now I'd like to shift the focus of my remarks to a broader issue, one central to the weapon system acquisition process—managing risk. As you know, our Nation's military capability is dependent—absolutely so—on developing and fielding the highest technology systems our scientific base can offer. It is the only effective tool we have to counter an adversary who consistently outspends us, outproduces us and outnumbers us. We must continue to grow and exploit our technological advantage so that our military forces can deter aggression and, if necessary, fight outnumbered and win. That means taking risks, prudent ones, and managing them to the best of our ability.

Risk is inherent to the weapon system acquisition process, and is essential if we are to keep expanding the technological frontier. But, by accepting risks, we also build uncertainty to defense acquisition programs—uncertainty that increases the further we push into the technology future. One of our jobs is to ensure that the risks we take at each step of the acquisition process are prudent when balanced against the technical challenges, the national urgency, and the resource requirements of a prospective new system.

That's what we did with the Peacekeeper ICBM, a remarkably successful program and a perfect example of one in which we pursued a prudent risk approach at each sequential step of the weapon system acquisition process. Peacekeeper went into development in 1979, did not enter production until 1984, and achieved a successful initial operational capability in December 1986. The development and production steps were accomplished largely sequentially, and total time spent from development to IOC—seven years—is representative of a "normal" or prudent risk program, one in which we understood reasonably well the uncertainties we were accepting at each step in the acquisition cycle.

The acquisition cycle for the B-1B, on the other hand, was compressed and development and production proceeded concurrently. This involved more risk than in the more classic, sequential process, and entailed more uncertainty. The Congress of the United States and the current administration fully recognized these risks, and ac-

cepted them as prudent when balanced against the urgency to bolster the increasingly obsolescent bomber leg of the triad.

My point is that the problems we are seeing in the B-1B today are products of the risks we accepted when we decided to develop and produce the aircraft concurrently. In the short term, problems attract great attention and require great energy and careful management to resolve. However, in the longer term, we will view these problems as part of the normal maturation process all programs and all systems experience.

That was precisely the case with today's frontline air superiority fighter, the F-15. We fielded the F-15 in the early seventies, not without some of the same maturation pains, but we bought a decade of air superiority which is now being eroded by the capabilities of new Soviet aircraft. We must buy that margin back, and we will, with the advanced tactical fighter in the 1990s. The ATF will have not only superior performance but greater reliability and maintainability as a result of a little-known, quiet revolution in our technical thrust for greater reliability and maintainability. In 1980, the F-15 was criticized as being too complex and "always" out of commission. Today, the more "mature" F-15 enjoys an in-commission rate far greater than older, more simple aircraft. The F-16 fighter has an even higher in-commission rate and can, on a continuing schedule, generate more sorties per aircraft per day than could an F-4, F-86 or even the P-51, each the technology standard-bearer of its day. We achieved this by pressing the frontier of technology and shouldering the associated risks, which were substantial.

Our challenge, then, is to create and foster a development environment which brings realistic expectations to the acquisition process but that allows us to field weapons as rapidly and affordably as possible. All systems entail risks—be they cost, schedule or technical, or all three. Given realistic goals, a prudent amount of risk generates a great deal of technology leverage and ultimately superior combat capability. Technological superiority remains the wellspring of defense for this country—and that's why we simply cannot accept a "no risk" policy in acquiring and fielding our future weapons systems.

As members of the media, you have an important responsibility in conveying to the public a balanced account of defense acquisition stewardship. I believe strongly in the need and in your right to tell that story. But I also believe strongly that weapon system acquisition must be portrayed for what it really is—an undertaking in risk management. In his book "Governing America," Joe Califano offers some advice to those who would try to understand American politics: "Try to tell the difference between tides, waves and ripples." The same advice is appropriate for those who report on the business of defense acquisition.

I think we all share the view that technical problems in development, cost growth or schedule slips do not, of themselves, tell us whether a program is worthwhile or not. We must make our "go-ahead" decisions judgmentally, measuring the goals of an undertaking against its expected payoff, a calculation that requires estimates of risk and uncertainty. We didn't stop the space program, or the Panama Canal or the Nation's great experiment with democracy when we encountered the growing pains associated with risk. And we cannot afford to create an environment in which decision makers will, under perceived pressure, accept only those decisions which guarantee zero risk because zero risk translates to zero achievement.

In closing, I'd like to say that we have a lot to be proud of in the B-1B. It is a magnificient aircraft. The problems, both business and technical, that remain to be solved are trivial when compared to the ones we've put behind us during development and production. I expect the B-1B to mature rapidly—and to perform even better than we expected when we began the program. It will serve us well for many years, largely because of the risks we took to incorporate new technology. And, had we chosen to delay production by a year or two, with a certain cost increase of three to four billion dollars, we probably would still not have averted all the problems.

The B-1B is the most advanced bomber in the world. It is here today, on alert at Dyess AFB and capable of carrying out its strategic mission—and that's exactly what we set out to do when we committed to the program. This aircraft, like other upgrades to the combat capability and deterrent power of the U.S. military, did not result from improvements "at the margin." If aviation history teaches any lesson at all, it is this: "no risk" means "no payoff."

Thanks very much for your time.

Senator GLENN. So Mr. Chairman, today General Chain, General Randolph and the other witnesses will give us another perspective on the status of the B-1B. It may be the most important perspec-

tive this committee will hear, since these are the men whose lives will depend on the combat capability of the B–1B.

Thank you.

Senator EXON. Thank you very much, John, and let me just take a moment to congratulate you on that 25th anniversary the other day. That was a great day for America, and you were an integral part of it. I cannot tell you how pleased we are to have you on the Armed Services Committee.

Senator GLENN. It is all a mistake, Jim. I cannot be getting that old.

Senator EXON. Well, you were only 11 years old when you did that. Some people do not remember that.

I would like to enter into the record now the statement of Senator Thurmond, which will be entered into the record without objection.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT OF SENATOR THURMOND

Mr. Chairman, as we begin this year's strategic subcommittee hearings, I want you to know how much I look forward to working with you on these important issues. As is the case each year, there is much work to do in the strategic area. I thank you for holding this hearing on the B–1B bomber. As you know, I thought it was important to hold hearings to set the record straight with regard to the B–1's problems.

I join with you Mr. Chairman in welcoming our witness this morning. General Chain has a distinguished military record and it is a pleasure to welcome him back to the Committee in his new role as the Commander-in-Chief of the Strategic Air Command.

As the operational commander of the B–1B aircraft that have been delivered to Dyess Air Force Base, General Chain is in a unique position to tell the Committee how these aircraft are contributing to the fighting capability of the Strategic Air Command. We read in the press about certain limitations of the aircraft. I look forward this morning to hearing whether these limitations are factual, and if they are, whether or not they adversely affect the operational effectiveness of the aircraft.

Mr. Chairman, I think all of us have questions about the financial liabilities resulting from the B–1B's problems. It is my understanding that there will be a future hearing on the bomber programs that will provide an opportunity to discuss these issues.

Thank you Mr. Chairman. I look forward to working with you this year, and I look forward to hearing the testimony of our distinguished witness this morning.

Senator EXON. I did want to read one part of the statement of Senator Thurmond. He said:

I join with you, Mr. Chairman, in welcoming our witness this morning. General Chain has a distinguished military record, and it is a pleasure to welcome him back to the committee in his new role as Commander-in-Chief of the Strategic Air Command.

General Chain, we are delighted to have you.

STATEMENT OF GEN. JOHN T. CHAIN, JR., USAF, COMMANDER-IN-CHIEF, STRATEGIC AIR COMMAND, ACCOMPANIED BY LT. GEN. BERNARD RANDOLPH, DEPUTY CHIEF OF STAFF FOR RESEARCH, DEVELOPMENT AND ACQUISITION; LT. COL. MICHAEL KENNY; MAJ. MICHAEL ELLIOTT; AND CAPT. FREDERICK STRAIN

General CHAIN. Thank you, sir.

Mr. Chairman, Senator Glenn, first let me endorse what both of you have said in your opening remarks. I appreciate the objectivity

by which you approach this. As far as your interest in the conventional role, Senator Glenn, I would like to digress for a moment and tell you that as of January 1 everybody in the Strategic Air Command is training today for the conventional role. We are a multicapable command, nuclear and conventional, and we are putting equal emphasis on both.

We are delighted to be here. For the past few months the B–1B has been written about objectively by some responsible journalists who have addressed its capabilities and its limitations. It has also been trashed by a couple of people who do not know what they are talking about, and I do not know the reason. I do know that they have done it through a combination of truths, half truths, and falsehoods, and by so doing have given incorrect information to the American people with the intent to deceive, and there is a dictionary definition of what I just said.

I am, therefore, very pleased to be here and that you all are addressing this issue. It will serve our country well to get the truth out.

I would like to make three points, and then I would like to introduce my colleagues who are the only experts in the room because they fly the airplane. We also have General Randolph here to be able to answer questions about the development.

My first point is that the B–1B is not an airplane. It is a warplane, and as such we must push the state-of-the-art, and we must push technology. The United States is only a few years ahead of our adversary, and we must stay in front. Airplanes are what we sell to commercial airlines. Warplanes are what the military needs and uses.

The second point is that all warplanes must mature, and they also must continually grow. Now, if you had asked me 2 or 3 years ago where the B–1B program would be today, I would have said just about where it is now. As the operational commander, I am the one who should be upset if the warplane does not meet operational requirements because I have the responsibility to see that it gets employed in combat, and I have no responsibility for its development. I am not upset. In fact, I am very pleased with the warplane.

The third point is that the B–1B is, as you have pointed out, the best warplane in the world today on anybody's side, and it is going to be an even better warplane tomorrow.

Now, before we respond to your questions I would like to introduce Lt. Col. Mike Kenny who has the most flying time of anybody in the B–1B. He has 450 hours, and he is an instructor pilot in the training squadron at Dyess Air Force Base in Texas.

Maj. Mike Elliott has 170 hours in the airplane. He is an instructor in the offensive systems, which we will want to talk about.

We also have Capt. Fred Strain, a defensive system operator and the one who employs the ECM capabilities in the aircraft, who is an active member of an operational squadron at Dyess.

These three experts, I think, will need to answer most of our questions today. You may ask some questions that will be best answered in a classified session, and if you should do that, sir, we will just identify that we can only go so far and then stop, but we obvi-

ously are here to answer anything and everything that you have on your mind.

Senator EXON. Thank you.

General, did you have any statement you wish to make?

Senator RANDOLPH. No, sir, I do not have any opening remarks.

Senator EXON. Well, let us start in with the questioning then.

First let me thank you again for being here. Now, let's get to the heart of this matter. Headlines are generally crafted in Washington, DC, critically. I have not had much experience in developing a major weapons system like the B-1B but I suspect that no weapons system we have ever had has been exactly on time nor has it come exactly within budget.

I would think it wise to recognize and realize that as the Soviet Union comes up with a new technology for its air defenses it would be prudent indeed for us to improve the B-1s capabilities even while it is still in production and by retrofitting those that have already been produced, with the things that would make it a more effective penetrator or a more effective weapons system.

Let me just ask the first question and Senator's rounds will be for 10 minutes at a time. I am delighted to see that Senator Wilson has now joined us, and we will be calling upon him next.

Let me ask this of the crewmembers that are here, Colonel Kenny and Major Elliott and Captain Strain. Do I assume correctly, that each and every one of you have had time in the B-52 program? Are you all experienced B-52 operators in the same capacity that you are playing now with the new B-1B?

Colonel KENNY. That is affirmative.

Senator EXON. I think the B-52 has been a great airplane and I, for one, will oppose its early retirement before we have adequate replacements on line. Regarding the B-1B, if each one of you had to carry out a mission tomorrow to penetrate the Soviet Union and you had a choice to carry out this mission either by flying in a B-52 or a B-1B, and given the present state of the art of the B-1B and your knowledge of what the B-52 can do, which aircraft would you choose to carry out that mission?

Colonel KENNY. Sir, I also am very fond of the B-52. I spent quite a few hours over Hanoi in it, and I was glad to be in the B-52 at that time.

I feel that there is no comparison to penetrating the Soviet Union or any other adversary of the United States in a B-52 or a B-1. The B-52 is not capable of descending or accelerating rapidly, flying low to the ground, weaving its way in and out through the countryside, striking the target as accurately, and getting me out of there quickly and back home.

Senator EXON. Major Elliott and Captain Strain, do you have any differing viewpoints on the statement just made by the Colonel?

Major ELLIOTT. Not at all, sir. The B-52, as all of us feel, was a good airplane. We both enjoyed the time we spent in it and respect the people that fly in the airplane, but I have no doubt in my mind right now that the B-1B is the better aircraft to be in from the offensive capability.

Senator EXON. Of course, my question points out, given the present situation, that you have, with the present B-1B, some shortcomings.

My next question to you will be to give this committee your viewpoint, as operators of the B–1B, on what the problems have been. To be clear, you would choose the B–1B in its present condition over the B–52; is that right?

Major ELLIOTT. Yes, sir.

Captain STRAIN. Senator, I am the guy at the bottom of the pyramid out there. I am the guy on alert all the time, ready to go accomplish my mission, and I have over 2,000 hours in B–52s. Without a doubt, I would take that B–1 to war tomorrow, and I am prepared to go tomorrow on a daily basis just the way it is. It is a much better airplane over the B–52 even in present condition the way it sits there on the ramp at Dyess.

Senator EXON. I am going to go back to both the generals in just a moment, but I would like to have from you operational people what have been your disappointments thus far with the performance of the B–1B. How do you feel, as operators of the B–1B, that we are coming along with correcting some of the problems that are given?

Colonel KENNY. I think, speaking from the people at Dyess who fly the airplane on a daily basis, our biggest disappointment is the way that the country seems to be accepting the airplane. We are very proud and very fond of it, and we have some problems that keeps us from flying sometimes just like a car that you buy new and you have to take back to get it adjusted. We kind of argue with each other down in the trailers who is going to get to fly it that day.

Major ELLIOTT. I agree with that a lot. The flying is what we are interested in and not the criticism that goes on. There are a lot of students down there trying to get checked out in the airplane. When we lose a sortie, it puts us a little bit behind. However, every airplane I have flown we have lost sorties for various reasons. That is to be expected.

The disappointments, if there are any, are small and short. As with everything we have been involved in before, we learn a little bit more every day. The maintenance people learn a little bit more every day, and we get smarter as we go. I do not see any deep disappointments, at least on the offensive side.

Captain STRAIN. I suppose most of the controversy has been over the defensive avionics, and I would imagine if there are any disappointments it is only that we are not as far along as we would like to be defensively.

I still think we have a far superior capability ECM-wise, electronic countermeasures wise over what the B–52 has today, but I think most of the defensive systems officers wish we were a little farther down the road on the sophisticated techniques that we will eventually be using.

Senator EXON. Let me try to pin you down a little bit more, gentlemen. You probably have not been up here before, but we try to keep burrowing in. Would each of you give me, in as short an answer as you can, what is the first improvement that you would like to see made to the present B–1B aircraft? Is there anything, or is it perfect?

Colonel KENNY. Well, sir, nothing is really perfect in the airplane. We would like probably to have formation tactics, something

that we can work out with them. We would like to have everything in the airplane 100 percent operational. We have several guys at Dyess who have flown the TFR system, but we all have not flown it yet, and we would like to do that and get it along the road.

Major ELLIOTT. As you may know, Senator, this system is computer intensive, and given a choice for me, I think as we go through each iteration of the computer software, as we bring it up to full capability, and that is a building process, that will improve the ability as far as full utilization of the system.

In terms of the hardware we have that in the airplane and the pull-up capability of it. There is nothing particularly more I need. It is just finishing the software on it as we program it day to day.

Captain STRAIN. I really have nothing to add, sir. I am exceptionally pleased with the performance. I just ride. I do not get to fly it, but talking as a fellow who sits in the back and has to go through the multiple gyrations that the pilots make, I am exceptionally pleased with the performance. I just wish the software effort would catch up to the installed hardware, and I think that is what the Air Force is trying to work on right now.

Senator EXON. I would like to switch back to the General now for my last question in this first round.

General Chain, as the operational commander of the B–1B, can you answer my question? What do you think is the first improvement that is necessary, and what would you like to put your finger on? If you could correct one particular problem, what would that be?

Then I would like to have also General Randolph answer the question as the R&D man.

General CHAIN. The defensive avionics, the ECM that Fred just talked about, is from an operation point of view, probably the one area that we need to get on with. I am personally satisfied having talked with the developers, and General Randolph can certainly emphasize that they have a handle on that and are working hard. There is going to have to be some money allocated to fix that and make it better.

As far as being able to do the combat mission that these people have to go do for us, if we were sent to war this afternoon I am quite confident that the airplane and crews could go in and successfully accomplish their mission and get back out, which is equally important to me.

The ECM would be the one thing that, if I had a wish, would be what we need to fix and what we would need to fix first.

Senator EXON. Thank you.

General Randolph, I guess you would probably agree, and if you do, what would be the second most important improvement in the order of priority that you would like to see?

General RANDOLPH. Of course, Mr. Chairman, I do agree. It is the electronic countermeasures which must be completed. In fact, of course, that is why we are asking you for money in fiscal year 1988 to the tune of about $400 million. Much of that is to work on the testing for the electronic countermeasures to complete the test program.

We have a three-phase program which responds both to the completion of the development and the changes in the threat as a

result of some things that the Soviets have done. So both of those things are being addressed as we go through the test program and as we complete the work that we should do in the ECM area.

Now, the second thing that we need to complete and work on is the flight control system. Senator, if I may I would like to talk to that for one second because the discussion has been in the media that the problem with this airplane is that it stalls in flight and wallows around like some kind of a duck. I think the flight crew members can tell you that that is absolutely false.

In fact, General Chain was good enough to let me go up and fly with the crews, and I was extremely impressed, particularly having spent a lot of time in the old B–47 and the B–52. I am here to tell you that that is a fantastic flying machine. We probably get hoisted on our own petard with terminology, and we have a thing that is called the stall inhibit system which would lead one to believe that the airplane stalls and, therefore, that we have to inhibit that. That is not what it means at all.

What we are talking about is an angle of attack control system whereby we identify the proper angle of attack to fly the most efficient profile and to make sure that the pilots do not have an excessive workload while they are doing that. We electronically control that angle of attack with something that we call the stall inhibitor system, which would lead you to believe the airplane stalls. Nothing is farther from the truth. We apologize for using imprecise terminology.

Clearly, that must be done because that is important for us to achieve all of the things that we need to achieve out of this airplane.

Senator EXON. Senator Warner.

Senator WARNER. Thank you, Mr. Chairman. If it is agreeable to the Chair, I will take 5 minutes and then pass to my distinguished colleague from California.

General Chain, it is a pleasure to see you again. Mr. Chairman and members of the committee, I am pleased to say that this fine and outstanding officer received his early education and start in life at Fork Union Military Academy in the Commonwealth of Virginia. He is due to come back this spring and address that student body.

General, when we talked about this in my office a short time ago, you recited your experience with the development of other aircraft and particularly the F–15 and F–16 and explained that, while it is regrettable that we are experiencing some early operational problems with this aircraft, you would qualify that the problems with this particular new system, in comparison with what we experienced on those other two aircraft, are not unusual.

Would you go back over that bit of history? I think it is important.

General CHAIN. Yes, sir, I would be delighted to. I think that Senator Glenn could probably tell more war stories than I could on the same type of things.

Now, I was involved in tactical Air Force bringing on the F–15. I was a wing commander at Langley Air Force Base in Virginia. When we first got the airplane, the radar did not work very well. We did not have any ECM on it. We used to have a thing called

stall stagnation which caused an engine to quit. However, we had two engines so that was not a big problem. We worked our way out of that, and I do not think that there is a better fighter airplane in the world today than the F–15.

The F–15 is a fly-by-wire airplane. We had some electrical systems problems when we first got the airplane, and we ended up with some airplanes that crashed because of the electrical systems. They have worked their way out of that, and that is a good airplane.

I was with the F–111 program, and you may recall that we had wings that fell off the first F–111s, and we had to rewing the airplane.

As I was explaining in my opening remarks, sir, these are warplanes, not airplanes, and in warplanes we have to push the state of the art; otherwise, we cannot be out in front of our adversary.

Senator WARNER. General, let us shift now and ask that you inform the committee about the performance of the aircraft at both high and low altitude, given that the aircraft was designed to be efficient for low altitude penetration missions.

General CHAIN. Yes, sir. With your permission, I would like to turn it over to the pilot who has 450 hours in the airplane, and I think my 1 hour or one flight does not match his experience. I think that Mike will be better able to answer it.

Colonel KENNY. Sir, this is a low-altitude penetrator, and to talk about the stall and the stability of the airplane, we, the operators of the airplane, defined in our performance manual, our dash one, that a stall is neutral stability. That is where the center of lift and the center of gravity meet. It is like balancing the pencil right in the very middle. That is what we define as a stall. It has nothing to do with the aerodynamic lift or loss of lift over a wing like you would on a 747 or 707 or any other airplane.

So when we talk about stall, we are talking about operating at neutral stability, which is difficult, and that is why we need a warning system. That is what the stall inhibit system will do.

This airplane is extremely stable at low level. It is much more stable than a B–52. It is much more maneuverable. I have personally flown the B–1B at 400 feet, turned 60 degrees of bank; pulled 2 Gs, gone around the mountains, weaved in and out to avoid farmhouses and other obstacles as we penetrate and go through the low level. I would do it at 200 feet but it is not really required. It is a national asset that we are dealing with, so we do not go down any lower for normal training missions, but it would do it at 200 feet, and it would maneuver well, very similar to a fighter-type aircraft. It is very fast and very stable at low altitude.

Most of the lift produced from this airplane or a good portion of the lift is produced from the body since the fuselage is actually a lifting body. However, its very small wings make flight at very high altitudes difficult. It is not designed to go up there.

I have no problems in climbing over thunderstorms that are 30,000 feet high. Personally, I have developed very high rates of climb from sea level up to over 30,000 feet. We just have no desire to fly up at high altitude, and so that is why we are down low.

Senator WARNER. Let me get one final question in with General Chain.

If the Secretary of Defense had made the determination to proceed on a fly before buy concept, it would have delayed the entry of the system into our inventory to meet specific threats. If Secretary Weinberger had taken that course, question No. 1 is how much longer would it have been before we could have anticipated operational use of this aircraft, and what would have been the implication on our ability to deter the threat if we had incurred this additional period of time between a fly before buy concept and the one we are presently operating on?

General CHAIN. If we had delayed the decision and went to a fly before buy, sir, we would have been at least 2 years behind. Today I have 29 B-1Bs that are capable of going to war this afternoon. A year from now I will have 100 B-1Bs capable of going to war, and we are not putting any B-52s in the boneyard.

I am tasked to hit more targets than I have the capability of hitting today. So every B-1 that comes on line adds to this country's combat capability, and with that combat capability we end up being a stronger country. Therefore, we are able to deter which is our ultimate responsibility.

So I think it would have been a poor decision to delay building the B-1B. That decision was not just Secretary Weinberger's but it was the direction and the sense of the Congress to have proceeded with this program.

Senator WARNER. It also has quite a conventional role.

General CHAIN. An outstanding conventional role, sir, and Senator Glenn raised that in his opening remarks.

Senator WARNER. I will pass on to Senator Wilson for the balance of my time.

Senator EXON. The Senator from California has about a minute and a half. The next witness under the rules would be Senator Glenn. I will be glad to yield for a minute and a half.

Senator WILSON. I will take a minute and a half. I have some other questions, but I must admit that I was struck by General Randolph's testimony. He pointed up once again the importance of being careful and precise about terminology.

Who is it? Is it the Air Force or the contractor who has the responsibility for devising the terminology for a new weapons system? I am grateful that someone decided to call it landing gear instead of crash inhibitor.

General RANDOLPH. Sir, or course, the Air Force bears the ultimate responsibility, although a lot of the terminology is developed by engineers. So, as I said, we will have to apologize for letting that kind of terminology go unnoticed, but it clearly is not precise and does not describe what the system is all about.

Senator WILSON. A more serious question and my last in this round, to come to the bottom line with all that has been written, your testimony this morning, I think, has painted a greatly different picture, but to come to the bottom line, admitting that there are problems, will the resolution of those problems affect either the schedule that you just alluded to, General Chain, or will it affect the total contract price for the weapon?

General RANDOLPH. Sir, with regard to the total contract price, as I am sure you are aware, we have done some exhaustive studies

on exactly what is necessary to make sure that we provide to General Chain the capability that we promised.

All of our analysis shows that the number will remain, under the worst case, below 20.5. In fact, our current number is 20.4 at so-called worst case analysis. So we find no evidence to support a claim that we will exceed the 20.5 number which we signed up to with the U.S. Congress.

Senator WILSON. That will not affect the schedule, either?

General RANDOLPH. No, sir. The schedule is as I describe it.

Senator WILSON. Thank you.

Senator EXON. Thank you, Senator Wilson. We will be coming back to you after we recognize the Senator from Ohio.

Senator GLENN. Thank you, Mr. Chairman.

Chairman Les Aspin over in the House has put out a statement that was in the paper a few weeks ago saying that not only is the Air Force going to ask for $800 million over the next 2 years to develop a solution to the plane's problems, but he said it may be as high as $3 billion. In a memo to the members yesterday when this was published, he said that the $800 "is only the tip of the iceberg. The fixes are likely to cost in excess of $3 billion and perhaps way in excess."

What is that to be used for, and do you know what he is talking about? If so, please tell us.

General RANDOLPH. Sir, I must say in all candor I have not been able to determine where the number of $3 billion came from.

As you may recall from the fiscal year 1986 budget to the fiscal year 1987 President's budget, about $1.3 billion was removed from the B–1B program. What we are asking for is restoration of some of that money to complete the testing and the development work that is, we admit, somewhat behind, particularly in electronic countermeasures.

Senator GLENN. Is that the $800 million?

General RANDOLPH. Yes, that is the $800 million, and let me clarify the $800 million. Of the $800 million, $600 million is to work on the bomber as we contracted with Congress to produce. There is $200 million to add some capabilities, conventional capabilities, forward-looking infrared and a 1760 computer. Those two issues are separate issues and obviously have to be discussed, debated and voted on.

Senator GLENN. That leads very well into a second question. Is that beyond what the first procurement specs for the airplane were?

General RANDOLPH. Oh, yes, sir, absolutely. The forward-looking infrared is a new system. It is an adaptation of the so-called LANTIRN Program that we use on fighters, and it is designed specifically to aid in enhancing our conventional capabilities.

Senator GLENN. We sweat blood over in the Pentagon in lining up the specifications for new airplanes to keep us ahead of the enemy.

In the specifications laid down for this airplane, where are the specs deficient that the contractor is required to adhere to and that you are required to test to?

General RANDOLPH. Sir, the one area that I can talk to you in terms of the B–1 today is in the area of schedule. We are talking

about completing the work. We do not have deficiencies in the sense that something is broken.

We do have deficiencies in the sense that, for example, the electronic countermeasures has not developed and matured on the schedule that we planned for the electronic countermeasures to mature. Thus, we are asking for the money in fiscal year 1988 to do testing to mature that system.

Senator GLENN. OK, you are behind on the ECM. We are not meeting specs on the ECM; right?

General RANDOLPH. Today, yes.

Senator GLENN. Why did the contractor not meet specs? Is the contractor responsible for that? Why do we need more money if he is not meeting the specs he contracted for?

General RANDOLPH. The contractor is responsible for doing the things that he needs to do. What we are asking you for is money to actually do flight testing, which is government flight testing, to test the system as the contractor goes through the maturing. We are not paying this money to the contractor. We are paying it to the government task force to do the necessary testing.

Senator GLENN. Terrain following—do we have that pretty well taken care of now?

General RANDOLPH. Yes, sir. In fact, we expect to deliver to Dyess today, and I have not checked, some minor software adjustments so that we can release the terrain following radar to the folks at Dyess this week.

Senator GLENN. This will take care of the pitch-up problem?

General RANDOLPH. Yes, sir. In fact, it specifically addresses that problem. If you will recall, on any digital radar you will get a thing that is called a spike or a false alarm on one scan and it disappears on the next scan. The software program that we originally had did not properly recognize that. We made a modification to that program, and that is what we are installing at Dyess right now.

Senator GLENN. The way it was described to me once, and correct me if I am wrong, if you are down at low altitude and you are reading on terrain following mode, which is very fast and very low, you are at approximately 0.85 Mach and something like 40° or 60° knots indicated at about 200 feet, and the real estate is going by very rapidly.

You can do this on automatic, and what they were getting was a signal, which the system then properly, as I understand it, recognized as being not normal and pitched you up to get you out of there. That is a safety feature, but it is not desirable for mission performance. So that is what has to be corrected. I think that roughly is what was happening.

General RANDOLPH. Yes, sir. That is generally correct, but that has been corrected. As I said, the change is being installed this week.

Senator GLENN. How about the fuel leak problem?

General CHAIN. I went out to Palmdale on Friday to look at the factory to see what the problem was. The basic problem with the airplane in the fuel leak area is behind us, and we do not have a problem.

The root cause was rather than putting fuel bladders into the aircraft, we just took every cavity and filled them up with gas.

That required putting sealant around all the different rivets. I think there is something like 250,000 or 290,000 rivets. The aft section, for instance, has 53,000 pounds of fuel in it, and it has stringers, ribs, and rivets that all required sealer around them.

The quality control on the first airplanes that were being delivered was not as good as it should have been. They have fixed the quality control, and we have basically fixed the airplanes that we had delivered which had a leak problem. Thirty years from now the B–1B will end up with seeps and weeps because of a basic concept. However, had we gone to the bladder system, we would not have been able to put as much fuel in it, and it would have added to the weight.

So we are very pleased with the basic construction, and the fuel problem is behind us. It is a yesterday problem that we are on top of.

Senator GLENN. General Chain, last week we had the Comptroller General, Mr. Bowsher, over. He is not a person who is normally given to overstatement, but in his testimony last week, he said about the B–1B, and I quote,

> It is clear that the current deficiencies reduce the bomber's capabilities and limit the strategic planner's flexibility in deploying the aircraft on the full range of missions initially envisoned.

Now, I would ask to what degree have the operational capabilities been reduced, and have your strategic planners had their flexibility limited?

General CHAIN. The answer is no, but I would let the crew talk about that.

Is there any mission you guys cannot carry out?

Colonel KENNY. No, sir. We can do the task that we were designed for, and we only know our specific targets and our own missions at Dyess, and we have one bomber on alert. We are not restricted at this time in any way. Even the airplane on alert today, without being released, has a TFR capability, and probably the best thing about the airplane is its capability to be down in the dirt and proceed along the terrain.

Major ELLIOTT. Each of the sorties that they have built for us at this time match very closely the sorties that would be designed for the B–52 or other deep strike aircraft. I do not see any appreciable difference in what we are doing or the targets we are going for.

General CHAIN. We have targets for 29 airplanes, sir. That is all the airplanes that we own today. All of them have missions assigned to them. As we get additional airplanes, they will be assigned. In a closed session, if you would like to go into more detail, I could talk to you more about that.

Senator GLENN. We might want to do that later.

Back to General Randolph again. I am not sure we finished up on the specs. Are there any specs outside the ECM thing that are not being met? I would like a specific list of where the contractor or the subs have not lived up to exactly what was contracted for. Do you have a list of those?

General RANDOLPH. Yes, sir. Let me answer the question this way, though. All of the specifications that we have given to the contractors, the contractors have signed up to meet, and those

cases where they have not met them and have not backed away from meeting those specs——

Senator GLENN. But are there any right now where they are not meeting them? Are there any that are still in that planning stage?

What I am getting at is the airplane capable of meeting its spec mission right now as we thought it would when we contracted for it. Now, if there are certain areas where it is deficient, even though the contractor is going to bring it up at his expense and eventually meet it, I want to know now what limitations exist on the airplane in not meeting the specs.

General RANDOLPH. The spec mission in terms of delivering bombs to the target at a certain range, the airplane can meet. The spec mission in terms of having all the electronic countermeasures we need, the airplane cannot meet right now, and the contractor has signed up to do that job.

Senator GLENN. Now, was that on the original ECM mission, or is this under a new threat analysis as to what the Soviets can do to us?

General RANDOLPH. No, sir. We have not yet reached the full spec on the original ECM in addition to the problems with regard to the threat.

Senator GLENN. To the upgrade?

General RANDOLPH. Yes, sir.

Senator GLENN. All right. I know my time is up, but your answer, I gather, is that we are meeting all specs right now except ECM; is that correct?

General RANDOLPH. Yes, sir. We are meeting all specs except ECM, and the stall inhibit system testing is not yet complete also. So those are two things that we have not yet finished our test work on.

That, in fact, will occupy a lot of the test time that we are doing in fiscal year 1987 and fiscal year 1988.

Senator GLENN. OK, but as I understand Colonel Kenny, the stall is not just an aerodynamics stall. This is a weapons delivery issue where you are working around a neutral stability point; is that correct?

Colonel KENNY. No, sir. In order to get to the heaviest gross weight, in order to put as much fuel on there as I want to or I can, then I drive my center of lift and my center of gravity very close together which puts me into a balance or neutral stability.

When this airplane approaches stall warning or neutral stability, it is just like we are sitting at this table. There are no aerodynamic cues. There is no warning system except for a computer-driven horn to say, hey, you are about to reach neutral stability, which we have said is stall.

So what the stall inhibit system will do is not to inhibit me from getting to this point or pulling back on the pole. I should not pull on the pole when I am balanced like this. I should be very ginger with my operations. So this system will give me a little feel in my stick that will get a little bit heavy on me and it will give me a warning to say, hey, you are close to neutral stability so do not horse me around right now.

Senator GLENN. I may want to come back to that a little later. My time is up.

Thank you, Mr. Chairman.

Senator EXON. Senator Wilson is recognized for 8 minutes for the balance of his first round.

Senator WILSON. Thank you, Mr. Chairman.

Gentlemen, you have, I think, responded to several questions that I did have. Just to be clear for the record, though, as far as you are concerned the fuel leak problem is fixed. It is behind you.

With respect to any problems that you had with the terrain following radar and flight control system, you are satisfied that those problems are behind, as well?

General CHAIN. The terrain following radar, we are satisfied that that is behind us.

The flight control system—we do not have the stall inhibit system installed yet, Senator, and when that is installed then we would be satisfied. We can fly the airplane today without it, but it is the protection system that Mike has talked about that we want to get in. So that is not behind us. It has not been installed in the aircraft yet.

Senator WILSON. What is the date for the installation?

General RANDOLPH. The testing on that is going on right now. We expect to start installation late this year and into the next year, 1988.

Senator WILSON. Could you comment on the dependency of the B-1B for aerial refueling in order to achieve its mission?

General CHAIN. Yes, sir. It is dependent on aerial refueling just like the B-52s are today. In the future when we go into the cruise missile carrying business, it will probably be dependent on aerial refueling, although we may be able to have some missions that do not need to have that capability.

KC-135 TANKER

Senator WILSON. All right, then let me ask you this, General Chain. Even anticipating that time and more standoff missions, would you recommend that there be an increase in the number of KC-135 tanker re-engining kits for the fiscal year 1988 budget?

General CHAIN. I am a strong supporter of the re-engining of the 135. I think it is very cost effective for our country, and I have a shortage of tanker capability.

The budget, as submitted, omits lots of things that I would like to see in it. However, I think that the Air Force and the administration did very well in trying to balance what the submission ended up being.

As strictly CINCSAC and a parochial person, I would obviously like to see more R-model kits, but I also understand when dollars are limited that some things are not going to make that cut, and that did not make it.

Senator WILSON. Does it have a sufficient priority so that in your judgment it needs to make the cut pretty soon?

General CHAIN. Yes, sir.

Senator WILSON. What you are saying, I think, is you recognize there are competing priorities, but from the standpoint of your mission, in order to really perform it you depend on aerial refueling. What that means is that the deficiency in that capability necessari-

ly means that there is a deficiency in the SAC capability over all until it is filled.

General CHAIN. Absolutely, sir, and as you probably know, every R-model that I have is worth 1½ times of what it replaces, and so for two kits I get an extra airplane. So it is a terrific increase in combat capability.

Senator WILSON. Thank you, Mr. Chairman.

Thank you, General.

Senator EXON. Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman, and welcome to all of you. Let me just go down the list of the things we have heard about. Others have done some of this, but I want to ask you the following question, whether or not each improvement or correction, however you want to describe it, is it our expense or the contractor's expense.

ECM TESTING

First, on ECM, how much of that is going to be at our expense, how much at the contractor's expense?

General RANDOLPH. Sir, the contractor signed up to deliver the system at the specified numbers, and we expect them to do that.

Now, having said that, we have to test it. The contractor is not going to pay for the testing. We have to pay for the testing, and that was part of the contract, that the Government would do the testing and the contractor would do the design and installation. They do the factory checkout, but we do the in-flight checkout.

Senator LEVIN. Was it foreseen in the contract that if the ECM is delivered, did not function properly, and improvements or corrections had to be made by the contractor, that the testing even on that fixed ECM would be at Government's expense?

General RANDOLPH. Yes, sir.

Senator LEVIN. That was expressly foreseen in the original contract?

General RANDOLPH. Yes, sir, it was expressly foreseen.

Senator LEVIN. What will be the added expense to us as a result?

General RANDOLPH. In the case of fiscal year 1988, of the moneys that we are asking for in the test program, about $150 million of that is associated with the ECM testing.

Senator LEVIN. Now, that is money which we did not foresee last year that we would be needing in 1988; is that correct?

General RANDOLPH. Senator, that is a rather complex question. As I pointed out, we were reduced by $1.3 billion between fiscal year 1986 and fiscal year 1987, and what we are really asking for is restoral of that money to do testing, but let me be exactly clear. The money that we had in fiscal year 1987 that was cut was procurement money. The money that we are asking for is RDT&E money, so it is in a different bin but it is nonetheless within the $20.5 that we told you.

Senator LEVIN. My question is different. My question was last year you indicated you would need about $28 million for R&D for 1988, but now you are asking for $415 million.

General RANDOLPH. Yes, sir.

Senator LEVIN. So you did not foresee in last year's budget request that you would need nearly as much money for R&D in 1988 as you are now asking.

General RANDOLPH. Yes, sir, that is a true statement.

Senator LEVIN. All right, so our elimination of a billion dollars at some point in this program had nothing to do with the current request or need, or is that not true?

General RANDOLPH. Well, again, the issue is a rather complex issue, in that what we promised to Congress is that we would do the job for $20.5 billion.

Senator LEVIN. When we cut a billion out, you said it was out of procurement, it was not out of R&D.

General RANDOLPH. That is correct.

Senator LEVIN. Now you need more money in R&D than you thought you would need, so our removal of a billion dollars in the procurement account had nothing to do with why you are now coming in and asking for $400 million more in R&D.

General RANDOLPH. Well, it had to do in this sense in that one of the things that you do in the test program is you look at the things that are wrong. When we looked at the test program, we found out that we needed to do more work in order to mature this system; so, therefore, we are asking for the money in RDT&E in order to mature the system.

Senator LEVIN. If we had given you the billion dollars in procurement, you still would have been coming in this year for the extra $400 million in R&D, would you not?

General RANDOLPH. No, sir. All we would do is ask you to move it from procurement into RDT&E.

Senator LEVIN. All right.

General RANDOLPH. The money would not change.

Senator LEVIN. I understand, but you still would have needed congressional action to authorize and appropriate money to this R&D account that you did not ask for before.

General RANDOLPH. That is correct.

Senator LEVIN. So it was not the removal of the billion dollars which caused you this particular problem?

General RANDOLPH. Oh, no, sir, absolutely not. We are not saying that at all. We are simply talking about the issue of the $20.5 and are we staying within the money, that is all.

Senator LEVIN. Well, I am not so sure you are not stating that at all. Secretary Weinberger put it this way. He said $20.5 billion was the predicted rate. We were getting it in at $19 billion. The Congress promptly took the money away from the program and assigned it to other things, creating the implication that it was the removal of that billion dollars which was causing the current problem. That is not a fair implication.

General RANDOLPH. Well, sir, I am not familiar with what Mr. Weinberger said.

Senator LEVIN. Do you not watch the David Brinkley Show?

Well, he said it in three other places, too, so that is not the only place he said it, but I do not think it is a fair implication. Look, if we have a problem we ought to fix it. We ought to assign responsibility for who should pay for it. If it is something we ought to do,

we ought to do it. If it is something the contractors ought to do, the contractors ought to do it.

We should not, however, it seems to me, suggest that because the Congress removed a billion dollars from the procurement account that that has something to do with why you are asking for $415 million for R&D this year. I do not think that is a fair implication.

General RANDOLPH. Well, all I can say is the point that we were trying to make is that we are continuing to live up to our contract with the Congress to bring this airplane in at $20.5 billion.

Senator LEVIN. I understand your point. I am talking about the other point, which is not a fair one, and I think you would agree.

Let me ask you about the other systems, if I still have a few moments, which I guess I do.

STALL INHIBIT SYSTEM

On the stall inhibit system, is that something which we are paying for or the contractors are paying for?

General RANDOLPH. Well, the stall inhibit system was originally paid for as part of the contract, and the contractor is going to deliver that system as we pay for it.

Senator LEVIN. So is this being fixed? Is that the correct word, or being improved? You give me the right verb.

General RANDOLPH. It is really being installed in the airplane. It is late on the schedule.

Senator Levin. In other words, this is not something that had been previously installed and did not meet specifications. This is something that is currently being installed.

General RANDOLPH. That is correct.

TERRAIN FOLLOWING RADAR

Senator LEVIN. All right, on the terrain following radar, is that being fixed at the contractor's expense or at our expense?

General RANDOLPH. At the contractor's expense, and the testing to date shows that is has been fixed, and we are about to release it to SAC.

Senator LEVIN. Now, you have explained about $100 million of the difference between what we said last year you would need in 1988 for R&D and what you are asking for in R&D. The difference, though, is about $400 million. You said, I think, about $100 of that is related to testing on ECM. What is the other $300 million for?

General RANDOLPH. Actually, it is $415 million. Of that $415 million, about $380 million is associated with the so-called base line program; that is, testing to handle things that are within the $20.5 program.

Senator LEVIN. Within the what?

General RANDOLPH. Within the $20.5 billion program.

Senator LEVIN. Was that not foreseen last year?

General RANDOLPH. It was not foreseen in terms of the amount that we are requesting this year. That is correct.

Senator LEVIN. Except that last year you said that the whole total amount you would ever need for R&D would be $41 million. I mean, last year you told us that you would need $28 million in 1988 and $13 million from the point on for R&D. So you said you

would need to total forever of $41 million, the way I add. Now you are coming in $415 million, and what I want to known is why. Explain the difference.

General CHAIN. The difference is we need additional flight testing on the airplane. We specifically need the additional flight testing in the case of the ECM that I have already talked about.

Senator LEVIN. That was $100 million, though, you said.

General RANDOLPH. $150 million.

Senator LEVIN. $150 million. That leaves $250 million.

General RANDOLPH. One of the things that we also did not ask you for that we should have asked you for is the money to demod airplanes that we are using in the test program that we need to turn back to the Strategic Air Command for their use that are now in the test program that have test instrumentation on that should not be on an operational airplane.

We did not have that money in last year because we mistakenly though that the job could be done with procurement. It turns out that the Comptroller said it had to be done in R&D.

Senator LEVIN. So how much is that?

General RANDOLPH. The total is about $75 million in a couple of different bins.

Senator LEVIN. So that leaves about $160 million.

General RANDOLPH. The other money is associated with the test force that is responsible for the cruise missile testing and the support of the airplane, data reduction, writing reports, engineers, et cetera.

Senator LEVIN. That was not foreseeable last year?

General RANDOLPH. We did not put in enough. The $41 million that you mentioned before, that included that. That clearly was not sufficient to do the testing that we now understand we have to do.

Senator LEVIN. My time is up. I think it would be useful for everybody here and for the public if you would supply for the record what that $415 million is made up of and whether or not it was just something you did not foresee, it was a new expense, or something, whatever the explanation was.

General RANDOLPH. Yes, sir. We have a listing, and we would be happy to provide that for the record.

[The information referred to follows:]

BREAKOUT OF B-1B R&D COSTS

The fiscal year 1988-1989 RDT&E request includes $415.5 million for fiscal year 1988. Of this amount, $375.7 million is for continued development of the baseline system. The remaining $39.8 million is budgeted for two enhancements, the Forward Looking Infrared (FLIR), and ECM update modifications.

Senator LEVIN. Thank you, Mr. Chairman.

Senator EXON. Thank, you, Senator. We will now have a second round of questions and try to hold the length of questions down a little bit. Those of us who live in Washington, DC, the storm capital of the universe, will not be able to play golf this afternoon, but if the General can get back to subtropical Nebraska this afternoon, he might get in 18 holes of golf, and I do not want to interrupt that unnecessarily.

I am going to be here until the end, so at this time I would be glad to yield to my colleague, Senator Glenn, for his second round if he wishes to take any thing up now.

Senator GLENN. Go ahead.

B–1B

Senator EXON. General, how many of the B–1Bs are right now on line for unrestricted mission assignment?

General CHAIN. Twenty-nine, sir. We have had 29 delivered to the Strategic Air Command, all of which are ready to go to war.

Senator EXON. What is the official Air Force position, as of right now, as to what date all 100 B–1Bs will be on line and ready for operation in the Air Force?

General CHAIN. The last one should be delivered to us, sir, in the summer of 1988.

As a side note, I was at the factory on Friday and watched the last section of airplane 100 start being built.

B–52

Senator EXON. With regard to the B–52s, you and I have privately talked about this both at SAC headquarters in Omaha and in my offices here. Would you please give your official word for the record on any early retirement of any B–52s as has been suggested in some quarters? I assume that you are not for retirement of any of those at the present time, and what do you foresee as the earliest possible date that we would be able to begin to retire any of the B–52s?

General CHAIN. It is propitious that Senator Nunn is here now, because he and Senator Glenn both are very strong supporters of SAC in the conventional role, and I do not want to see any B–52s go into the boneyard because of their latent combat capability, particularly in the conventional role.

General Rogers over in Europe needs to be able to attack second and third echelon forces, and the B–52 with its low altitude capability and huge bomb carrying capability and 2,000 mile range unrefueled can contribute in his theater of operation significantly. The same is true with General Crist, who is responsible for the Central Command, and the same is true for Admiral Hayes, who is responsible in the Pacific.

So it is my feeling today that we should not be putting B–52s in the boneyard. We will be modifying those airplanes going into the boneyards up through the early 1990s. We have the sunk cost, we have the investment, and we have the huge combat capability, and it just does not seem to me to make any sense, with the depth that we have in conventional capability, to take that type of capability out.

Eventually, an airplane like the B–1 is going to serve this country extremely well in that same type of role. The B–1, as you probably know, sir, will carry 84 500-pound bombs internally versus 51 bombs in the B–52, and so it is going to have a huge capability in the conventional arena in the out years, but in the near term I just cannot imagine taking the B–52s out of the inventory when the theater CINCs need that type of conventional capability.

Senator EXON. General Chain and General Randolph, I think we have covered in some detail most of the allegations that, for the most part, have been unrealistic and unfair. But there continues to be a lot of attention given to the fact that the B–1B does not fly as high as it was originally scheduled to fly.

Now, I do not know whether that is true or not. I suspect maybe it is somewhat lower in altitude than originally envisioned, and I suspect that that is true because of improvements and additional weight that have been put on the airplane.

Can you say in open session what the altitude generally of that airplane will be, and is it significantly lower than what was originally envisioned? If it is significantly lower, does it affect the capability of that airplane, given its mission?

General CHAIN. Perhaps it would be best if we let the people that are going to take it to war answer that.

Colonel KENNY. Sir, the top altitudes and the optimum altitudes for the B–1 are classified, and those things should not be discussed.

I do not know what the original design altitudes were for it. I know that my engines are more efficient as far as burning fuel and that they put out more thrust than they had originally designed or hoped. So I think that helps to compensate if we are a little bit lower than we should have been originally.

Of course, the whole desire is for us to be right down on the ground.

Captain STRAIN. If anything, sir, that enhances our capability. When we talk about penetrating enemy territory in the B–52, for instance, generally speaking you came in at extremely high altitude. The result was that early warning radars would see you coming hundreds of miles away from the coastline. In the B–1 at mid-altitude, it is much to our advantage. The time that they see us is much later than it was in the B–52.

As an advantage, it gives us a much, much better penetration capability to come in at that mid-altitude without any degradation to our range compared to the B–52. Our missions are essentially the same, the same range, the same time duration.

Senator EXON. General.

General RANDOLPH. Yes, sir. Let me talk about the comparison. The B–1B and the B–1A are aerodynamically very similar. As a matter of fact, there are really very slight differences. So, therefore, for a given fuel load and bomb load, they both fly at the same altitude.

Now, obviously if you add more weight to the airplane, it's ability to climb to a higher altitude is lessened, but given apples to apples comparison, it is the same.

Senator EXON. My last question will be to the two generals. Since I followed this program very closely for a long, long time, I am wondering if it is not fair to say that, looking at the B–1B program in retrospect right now, that the Air Force may have been somewhat less than totally realistic with the operational dates, the spending cap of $20.5 billion, and the fact that maybe all of the new weapons system components may not have been incorporated in with that original $20.5 billion estimate.

I am talking especially about the flight simulators which are normally placed in total costs and possibly other things such as re-

placement spare parts and training costs. You can argue back and forth, but I think generally speaking those things have been included in the overall cost of the new weapons system.

Maybe we were a little bit less than realistic in the timing, the dates and the costs of this in the initial instance in order to gain its approval. Is that a fair assumption on my part, or do you both disagree violently with what I have come to as a preliminary conclusion? What I am saying is that maybe some of the criticism that is being launched now could and should have been anticipated earlier.

General CHAIN. I think you can compliment yourself, Senator, on having supported a very good program. It has come in on time and basically within cost. So I think it is a huge success, and there is nothing to be embarrassed or ashamed about.

I think the one thing that our country does to itself and we in the military do to ourselves is that 5, 6, 7 years before a program is going to reach its capability, we define specifically a date on a calendar, say November 1, 1994, that I am going to produce *x* number of airplanes, and there are going to be 10 airplanes on alert with an initial combat capability. I think that we then start working against false standards.

I think the Navy does it much better with its ship development. You take submarines. They produce three or four submarines of the same class submarine. They break the champagne over the bow of the submarine, and then they take 6 months or a year or a year and a half while they go through sea trials and work out the bugs and find out what is wrong, fix them, and then put it into the fleet.

We in the airplane business, however, end up saying that on such and such a date 6, 7, 8 years from now we are going to have the combat capability. We take that airplane right out of the factory and put it immediately into an operational unit and immediately expect that to be meeting all the parameters of the basic design.

Yet there is no doubt in my mind in the year 2050 whatever airplane is being discussed then or space plane, there will be some growing pains. That goes with pushing the state of the art for warplanes. As long as we are dealing with warplanes, we should not be as specific on the dates. We should be specific on the date we want to get it from the factory, but as far as telling our country that we will have full combat capability 3 days after we pick it up from the factory is just a false target.

So we have put ourselves into a box, and I think we in the military need to think that through and reeducate ourselves and then reeducate the rest of the people that we have to deal with, because we set false standards and then measure ourselves against those standards, and thereby do ourselves and you and the American public a disservice.

Senator EXON. Anything to add, General?

General RANDOLPH. No, sir. I guess I really would like to say that we promised SAC and the country and the Congress that we would deliver a combat capability in October of 1986 called the B–1B within $20.5 billion, and we have done exactly that.

Senator EXON. Did you include all of the things that I mentioned that are ordinarily included in the weapons systems?

SIMULATORS

General RANDOLPH. One of the things that you mentioned was simulators, and if you recall, Senator, when we came to the Congress, simulators were kept separate in the B–1B program. In fact we had a simulator SPO where we developed several kinds of simulators simultaneously. We explained to the Congress that we would like to keep the simulators for the B–1B in a separate line, and Congress approved that. So that was done clearly with the consent of the United States.

Senator EXON. That came out of Operations and Maintenance, did it not?

General RANDOLPH. No, sir, not the development of the simulators. The training funds came out of O&M but not the development of the simulators. The simulator is in a separate line, but that was clearly delineated to the Congress as part of the program. It is not something that we tried to hide or ignore.

Since that time, the Congress has told us to put the simulators in the line with the airplanes, and that is what we did in the case of the ATB, but the practice at the time was that they were kept separate.

Senator EXON. So you plead not guilty to any fudging?

General RANDOLPH. Yes, sir. I am afraid I plead not guilty.

Senator EXON. I am delighted to recognize the chairman of the Armed Services Committee, Senator Nunn, who has entered the room.

Senator Nunn, we are glad to have you.

Senator NUNN. I do not want to get in front of Senator Glenn, Mr. Chairman. He said he has already had a turn. I just wanted to ask a couple of questions.

B–1'S MOST SEVERE PROBLEM

General, what are the main problems and what is the most severe problem you have with the B–1? I have missed part of this, but what is the most severe problem?

General CHAIN. The most severe problem, sir, is getting the ECM capability, the defensive electronic countermeasure capability, up to the standards that we would like to have them.

Senator NUNN. I do not know how much of this can be talked about in an unclassified session, but what is your confidence level on a scale of 1 to 10 that you are going to be able to remedy those problems with the ECM, 10 being the highest confidence level?

General RANDOLPH. With reference to where we expect to be right now, our confidence is probably nine that we will achieve that. With reference to where we have expected to be at the time we designed the system, our confidence is probably eight.

Without getting into classified testimony, what I am talking about is that the Soviets have done some fairly innovative things which we now have to worry about.

Senator NUNN. So you are saying what you expect right now to be able to do is at level nine. Your confidence level, based upon what you originally expected to do, is eight.

General RANDOLPH. That is right. There are things that have changed. The Soviets have changed and now we are going to have to figure out ways to defeat those changes.

Senator NUNN. What is your confidence level with respect to those Soviet changes?

General RANDOLPH We understand what the Soviets have done. We understand how to go about doing that. What we will have to do, however, is come over to the Congress and ask for improvements to the system. That, to me, represents a different issue, and the Congress is going to have to debate as to whether or not it is appropriate to give us that.

Senator NUNN. You do not want to name a confidence level on whether you will be able to meet those Soviet changes?

General RANDOLPH. Yes, sir. The changes, as we understand them today, my confidence level that we will be able to meet that will be at a nine level.

Senator NUNN. If you have the money to do it?

General RANDOLPH. That is right, if we have the money to do that.

Senator NUNN. Some people testified at the very beginning of this debate on the B–1 that that was exactly what would happen, that we would get to the point where we are now and we would find the Soviets had done certain things, and we would then have to do certain other things, and once we did certain other things, they would do certain other things, and then, there was going to be a spiral and that the ECM could offensively never keep up with the ECM defensively. That was the heart of the argument against the B–1B.

So how do you address that question? Are we ever going to stay ahead of the curve in terms of the B–1 being a penetrating bomber?

General RANDOLPH. We will stay ahead of this curve for the time that we explained to the Congress that we would expect to stay ahead of the curve. Again, if I get too specific I will get into classified details but, if you recall, that was the rationale behind pressing forward with the ATB.

You are exactly right, Senator. The electronic countermeasures is a difficult, difficult problem. We were always in the midst of move and countermove activities in electronic countermeasures, and so the answer is to not depend on electronic countermeasures; thus, the ATB. The ATB is also a very difficult technical challenge, and it was our judgment that we needed the B–1 as an interim until such time as we were able to bring the ATB on line.

Senator NUNN. General, if you could back up now, knowing what you know now, would you design the B–1 to be a penetrator or would you primarily spend the money in making the B–1 a good conventional standoff cruise missile carrier?

General RANDOLPH. Senator, knowing what I know right now, I would design the B–1 to be a penetrator. The B–1 today, right this minute, without the ECM up to its full capability is an outstanding penetrator. It is the best manned bomber in the world.

I might point out the fact that penetration depends on altitude, speed and radar cross-section, and in the case of altitude, of course, the B–1 flies at a very low altitude, very high speed. Radar cross-

section has been considerably reduced over the B–52. It has an excellent receive capability in the ECM, and as soon as the jamming capability gets up to standard we will have an outstanding penetrator for the time that we explained to the Congress that we would expect to.

Senator NUNN. This gets into other areas that you may want to defer to a closed session, but the United States still has on the table a proposal which we proposed at Geneva to eliminate all ballistic missiles within 10 years. If we do not have ballistic missiles and there is no ballistic missile laydown in advance of a bomber attack, General, what does this do to our ability to penetrate both with the B–1 and other assets?

General CHAIN. It would obviously complicate it, sir. But I would like to add that the part of the ECM used for threat avoidance, the No. 1 rule in penetration works well in the airplane.

No. 2 is to kill it, and we have on-board mechanisms by which we can kill things that are in the way as we penetrate.

No. 3 is to jam.

Perhaps it would be best in response to your question, Senator, if we let Capt. Fred Strain talk to you a little bit about the defensive avionics aboard the airplane, its combat capability, and his confidence in being able to carry out the mission today because he is the operator of that system.

Senator NUNN. Well, the main thing I am really getting at with this question is, if we do away with ballistic missiles, what happens to the penetrating capability of the B–1 bomber?

General CHAIN. If we do away with ballistic missiles, we will still have cruise missiles. The cruise missiles would also be given consideration so that as far as the strategic chess that will have to be played out at the Strategic Air Command as we try to work with the SIOP, that will have to be taken into consideration.

Captain STRAIN. There is a bad impression, I guess, going around or some bad press that we attempt to penetrate enemy territory with no countermeasures capability at all, and that is absolutely false.

If I could put this in perspective, it is a lot like having the neighborhood bully, and the best way to get rid of the bully is, No. 1, poke him in the eye. No. 2 priority is, if you can, you hit him in the stomach. As a last resort, you can kick him in the shins. Unfortunately at this time in the B–1 program, I probably cannot poke him in the eyes or punch him in the stomach, but I can sure kick him in the shins. Not only that, I am the smallest guy on the block radar cross-sectionwise, and I can run like a pail of beans.

So we have the capability, and even if sometimes we have to go with what might be the second or third countermeasures priority technique, that technique is still better than what we asked the B–52s to utilize in their penetration.

You asked the question, Senator, about what would happen if we do not have laydown. We still have on-board capability for surface-to-air missile suppression. I would expect that that would occur then, that we would utilize on-board capability for SAM suppression.

Senator NUNN. Thank you very much.

ELIMINATION OF ALL BALLISTIC MISSILES

General Chain, has SAC done an analysis for the Joint Chiefs as to the effect on your overall SIOP if we eliminated all ballistic missiles, assuming both sides did?

General CHAIN. Yes, sir. Both my SAC staff and also the JSTPS staff are doing independent studies and making that information available to the Joint Chiefs.

Senator NUNN. Is that information available now? Has it already been completed and submitted?

General CHAIN. Where we are is that it has been submitted. It is the type of thing that continues. You know, 3 years from now we will still be refining, but yes, we have gone forward to the Joint Chiefs with our input.

Senator NUNN. At what point could the committee get the results of that study? We would like to have it. I am sure it is classified.

General CHAIN. I appreciate that. I will have to check.

Senator NUNN. Would you check it out for us and let us know?

General CHAIN. Yes, sir.

[The information follows:]

ELIMINATION OF ALL BALLISTIC MISSILES

SAC and the JSTPS were tasked by JCS to contribute to their efforts to study the ZBM issue. The results of those efforts are reflected in JCS papers which are intended for the Secretary of Defense and the President. JCS/OSD maintain purview over those staff actions.

Senator NUNN. Let me ask one other question. My time has expired, and I will make this my last one.

General Randolph, we are going to have some big questions, of course, on the B–1 but also some big questions on the advanced technology bomber.

The biggest problem you have is the ECM problem, the electronic countermeasure problem with the B–1. How does that translate to the problems we may have for the advanced technology bomber? In other words, should we be looking for the same problem with the advanced technology bomber, or is the cross-section so much lower there that you basically do not have that ECM problem?

General RANDOLPH. Sir, we do not have the ECM problem. I guess I would prefer to wait until we go into closed session to go much beyond that, but the answer is no, we do not have the same problems with the ATB.

Senator NUNN. So the biggest problem we have with the B–1 is not likely at least to be the same kind of problem with the advanced technology bomber?

General RANDOLPH. That is a true statement, yes, sir.

Senator NUNN. Thank you.

Thank you, Mr. Chairman.

Senator EXON. The Chair recognizes the Senator from Ohio with a question. Since I assume that 25 years ago in NASA you also down faced technical challenges, how late was your flight and how much over budget was it?

Senator GLENN. No comment.

Senator EXON. Senator Glenn.

Senator GLENN. On the 11th scheduled date we finally went.

In responding to Senator Nunn's question here about the elimination of all ballistic missiles in 10 years, that is an issue that has bothered me a bit. If we want to make the People's Republic of China the dominant nuclear power in the world, that would do it unless we are going to get them into the negotiations.

Also, if we are going to go that route, we had better be upping our expenditures in conventional weapons or we will make the Soviets the world's No. 1 military power. So we have to tread down that path rather carefully. That is not a question, just a statement.

Let me get back to the ECM issue for just a moment. You have two kinds of electronics on the airplane. You have offensive electronics, and you have defense electronics. Are these compatible as you are flying the airplane now? I have heard rumors that there is some incompatibility that, in effect, can almost jam each other when used together, and that means that you have to pick your mission, whether you want to go offense or defense.

Captain STRAIN. No, sir, that is entirely untrue. In 3,000 hours of operational flying time at Dyess, the DSOs that I have trained and myself have not seen one instance where the defensive system jams the offensive system.

Senator GLENN. How about vice versa?

Captain STRAIN. Or vice versa, sir. There is a lot of confusion going on here, and I think what has happened here is that somebody has taken something out of context or does not quite understand.

In any good system compatibility problem, you want to make sure that two systems do not operate on the same frequency, and there was a time in the test program where the defensive system would tell the offensive system not to utilize a particular frequency because it thought there might be a threat operating there. Those problems were all taken care of.

What would happen essentially is it would build up a series of frequencies, and that limited your capability offensively, but those were taken care of very early in the program. Even if that occurred today by some fluke, we have the capability as operators to go into the system computers and say please avoid this radar frequency. It takes us about 5 seconds to do.

Senator GLENN. Is there any mission that you are assigned or any potential mission, where you do not see any difficulty with the offensive and defensive avionics systems working simultaneously and fully as contemplated?

Captain STRAIN. Sir, there is not one flight profile or one mission, training or operational, where the air crew has to make the decision to defend the bomber or attack the target.

STABILITY

Senator GLENN. OK. Back to the stability again, Colonel Kenny. I want to get into that just a little bit. I am not sure I understood completely your explanation of that.

I thought all the time we were talking aerodynamic stall. You are talking about center pressure, center lift, and I understand

that. We have certain excursions permitted on an airplane around that center pressure, whatever the flight regime is.

In fact, the one B–1 was lost when they were flushing out the envelope in the low speed, low altitude end of that thing where the CG, the center of gravity, was out of kilter for the control authority and the lift and everything else with the wings back. That is a problem. It is just a matter of fuel management and keeping the CG within the proper limits.

As I understand from what you are saying, though, you are saying that this excursion permitted with the center lift around the center pressure gets down to the point where you really cannot vary from that or then you would get into an aerodynamic stall. Is that correct?

Colonel KENNY. Sir, the speed that we would have to get to for the wings to aerodynamically stall is well below the longitudinal stability speed. What this airplane has, as most modern airplanes do, is an instability on a certain axis.

The B–1 has what you would call longitudinal instability. What that means is that the wings will not stall and lose lift because you get to a point where you are so slow with such a high angle of attack that the center of gravity moves aft of the center of lift, and then it does rotate about that longitudinal axis.

What we need in this airplane, because we have no buffet on the wings, is some kind of indication to tell us when we are getting close to neutral stability. We will eventually be working maybe someday beyond neutral stability. I believe the F–16 operates around that regime itself. It is a very fine wire to operate on, but with the type of computers and equipment that we have we can actually work back in that regime.

I want to be as heavy as I can. I want to be able to load as much stuff on this airplane as I can, and that puts me to a point where I am going to have to have a high angle of attack to provide enough lift, and then I have to be careful about this area of neutral stability. We work on the front side of it right now. We are pretty far on the front side, but as we get heavier and heavier with the airplane, we get closer and closer to neutral stability.

Senator GLENN. Are you cutting your maximum load now to stay within those limits?

Colonel KENNY. The operational people are flying with a gross weight limitation.

Senator GLENN. Then this cuts down your range, so that the airplane is not as capable of performing its full range SIOP mission than as we talked about a while ago; is that correct?

Colonel KENNY. The tests, the operational missions that we are operating are in Colorado and Texas, so we are talking about a training sortie.

Senator GLENN. OK, General, how much are we downloading the airplane now, and what does this do to its range if we had to go to war tomorrow?

General CHAIN. We can accomplish all the missions we have laid out in the SIOP today with the airplanes we have. Where I really need the heavy weight is when we get into the cruise missiles. That is going to be an additional 50,000 pounds.

Senator GLENN. You are saying missions assigned today, but on the design of the airplane, it was designed for certain SIOP missions down the whole range, and we are familiar with those. Is it downgraded from that as of today?

General CHAIN. No, sir.

Senator GLENN. Then if we are flying it downloaded, we are not flying at the maximum gross it was designed for. How are we getting the same range out of it then?

Captain STRAIN. Sir, if I could bring this down just a couple of notches for the rest of the committee. Let me explain what is going on here.

Most airplanes, if you get too slow or you get too fast or you pull back too hard on the stick, the whole airplane starts to shake, and that tells the pilot you are going to stall the airplane. This airplane does not do that. It is so aerodynamic and gets so much lift from its body that there is no artificial shake to the airplane that tells the crew you are going to get out of control.

Thus, Colonel Kenny as the pilot, needs some kind of warning to tell him that he is pulling too far back on the stick, he is attempting to do too much with the airplane, so he needs something to tell him that that is going to happen. That is what SIS does. It makes his stick get harder to pull as he approaches those stall limits.

To answer your question, Senator Glenn, we need the additional stability systems for the ALCM missions only.

Senator GLENN. I understand that, but you are downloading. As I understand it, you are not flying at the designed maximum gross weight of the airplane as of today. It is not cleared for flying maximum range missions at maximum gross weight.

But you still have a desire to fly at the maximum gross weight of the airplane. We are cutting back on the range of the airplane; is that correct or not?

General RANDOLPH. No, sir, that is not correct. The airplane is capable of doing the missions that SAC needs to do today with the airplane.

Senator GLENN. No, General, I want to come back to the designed mission the airplane was laid down for. We said that it is meeting all of its specs a while ago except for some on the ECM, but if we are downloading it—I am not talking about what it is assigned today. It is assigned today to a mission we know it can perform.

I am talking about that versus the spec mission that we paid for to design a certain capability, and as of today, as I understand it, we are downloading the airplane. We are not flying at the same maximum gross weight which would give it that mission. Is that correct or not?

General RANDOLPH. No, sir, that is not correct.

Senator GLENN. We are flying at maximum gross weight, then?

General RANDOLPH. We meet the spec mission. The spec as we gave it to the contractor, the contract can meet, and the airplane is capable right now of flying the spec mission.

What we would like to do in the future is add cruise missiles to the airplane, and we want to add the stall inhibit and stability enhancement functions to insure that we can do that at the proper altitudes and meet the ranges that we would like to see.

Senator GLENN. OK, so we are flying at the designed maximum gross weight of the airplane if we want to today, and it does have enough stability to deal with that.

General RANDOLPH. That is correct, yes, sir.

CITS

Senator GLENN. How about your maintenance help on the airplane? You have quite an exotic system. It monitors everything and comes up with a whole series of lights you interpret as to where the problem is and how you are going to fix it.

What do you call that system?

General CHAIN. That is called CITS.

Senator GLENN. It is a maintenance help, anyway. It tells you where the problem is and what you are going to have to do to correct it. One of the reports has been that it makes so many false alarms that it is virtually useless as a maintenance tool.

Is that affirmative or not?

General CHAIN. No, and I would let the crew talk to that.

No. 1, I think it has to be brought out that the contractor met his specs. They have improved it significantly since then with the goal of bringing it down to a very, very low level, but I think it is best if the crew explains it to you.

Major ELLIOTT. The false alarms they talk about, Senator, involve the constraints that they put on what the system is going to monitor. The engineers told it to look at oil pressures, for instance, on an engine. It will monitor precisely whatever parameters they give it for that engine. Unfortunately from the engineer's point of view, we did not clearly explain to them the starting of the engine, the stopping of the engine, and the in transient oil pressure reading in between that would be normal operation limits for the engine but the oil pressures parameter in this example would exceed the limits of the monitoring systems.

Once they became aware of that, they just continually tighten the software or open the software parameters up to be more realistic.

The false alarm rates that they are talking about were very early. We have seen a dramatic improvement in the years since I have been flying the airplane. In each iteration of the software, it comes down further and further.

Now, the air crews also have the capability to interpret that. We do not just blindly look at what the CITS says and ignore what the rest of the aircraft is telling us as far as instrumentation goes. So it is somewhat more of a problem from the maintenance standpoint, but we are able to manage that through codes that we can put into the system.

So in terms of being a major problem of the airplane, it is not at all.

General RANDOLPH. Actually, it is an interesting system because it monitors some 20,000 points on the airplane all the time throughout the flight. What we have promised the crew is that we would have three false alarms per flight by August of this year, and we are in the process of bringing the false alarm rate down as

we operate with the system and get more experience. Again, that is a software issue.

Senator GLENN. Seventy thousand?

General RANDOLPH. It monitors 20,000 points simultaneously throughout the entire flight.

Senator GLENN. My time is up, Mr. Chairman. I do have some other questions on the next round.

Senator EXON. Thank you.

As a layman sitting here listening to you pilots go back and forth on these things, you lost me somewhere along the line there. You said this aircraft is fulfilling its mission, but you are now flying this aircraft downloaded. Is that what you said?

Senator GLENN. They were not flying it downloaded. They are flying it at maximum gross weight. There had been reports that they were flying it considerably downloaded to stay out of these load characteristic issues, and that is one of the things I think is very key here. Because if you were actually having to fly it, then it cannot go its range and its full mission. But they say they are not flying it downloaded. They are flying it right up to maximum gross weight if they wanted to.

Senator EXON. Is it possible that we are talking about the original design of the B-1? The original B-1 was designed before we knew about ATB, and it was to be basically a penetrator.

I have gotten the impression that after the original B-1A was never built, the B-1B was still designed basically as a penetrator. As an afterthought, and I think a good one, we also finally came to the realization that eventually, down the line, we would use the B-1B as a cruise missile carrier. I suspect that when you are talking about a standoff cruise missile carrier, you are carrying more gross weight than you would if you were a penetrator going in to attack a specific target in the Soviet Union.

Is some of this difference between what this aircraft was originally designed to do and what we might have to modify it to do in the out years, is that part of the confusion that we are running into on this weight problem?

General CHAIN. Yes, sir. First, I would like to tell Senator Glenn that in a closed session we would like to come back to that issue so we can be more specific in some numbers.

But in answer to you, Mr. Chairman, yes, we added 8,000 pounds of structural buildup on the B-1B over the B-1A and made the landing gear heavier, stronger if you will, and hard points in the fuselage be able to carry the cruise missile. With the 8,000 pound investment, we are able to carry 50,000 pounds more weapons, cruise missiles, and 24,000 pounds more fuel to be able to accomplish the mission.

So we have 8,000 pounds more structure on the airplane, but we have a significant increased combat capability on the airplane.

Senator EXON. I have no further questions. Do you have further questions, Senator Glenn?

Senator GLENN. Just a couple.

The Evans article, which I am sure you are all familiar with, was published and put a lot of these issues in the public press and has caused a lot of comment. I think that is where it mainly started.

He had some credibility because he had formerly served on the staff of the Secretary of Defense as a program analyst.

His No. 1 charge against the aircraft on January 4 was that it is too heavy. At least 80,000 pounds were added to the original B–1A design of the 1970s. I think you answered part of that just now. It was not 80,000 pounds added, was it? With the 8,000 pounds structural change you made, was it possible then that there was 80,000 pounds maximum gross weight? Did it go up that amount from the original design?

General RANDOLPH. Yes, sir. You can carry that kind of weight. It was not added to the basic weight of the airplane. It was the carrying capability of the airplane that was increased.

Senator GLENN. He relates that to wing loading and says that 245 pounds per square foot on the B–1B then, double that of the B–52 and other commercial aircraft, I presume is OK for the mission of the B–1.

General RANDOLPH. Absolutely. He did the arithmetic on the wing loading number, but that arithmetic is not relevant to the mission. My response after I read the article was so what, what does that mean to anything.

Senator GLENN. Well, it is relevant in that it increases your stall limits when you have a maximum gross weight, what your envelope is, and the altitude that you can take the thing up to.

General RANDOLPH. Yes, sir, but we need to understand that as the Colonel pointed out, this airplane gets a lot of lift from the body, so wing loading alone, without talking about the design of the flying machine, is not a measure of merit that you discuss in isolation.

Senator GLENN. Is 245 then just wings alone?

General RANDOLPH. Yes, sir.

Senator GLENN. It did not have any fuselage lift in it?

General RANDOLPH. No. All he did was take the area——

Senator GLENN. Of the wing.

General RANDOLPH [continuing]. Of the wing and divided that into the weight, and he came up with wing load.

Senator GLENN. OK, if the body is a lifting surface then, what does it come down to on per-square-foot loading over the whole on the average there; do you know?

General RANDOLPH. I do not know, sir. We can give you that for the record.

Senator GLENN. Well, it is not important enought to be put in the record. I was just curious about it.

Colonel KENNY. We use that article in our coffee bar. We have a graffiti board up above that. There were a lot of things that he was misinformed on. Thrust was one.

Senator GLENN. Yes, that is the next point. It is underpowered. That is point two. The B–1s four engines provide a total thrust of 72,000. Each pound of thrust has to push about 6 pounds of airplane through the air. Thrust to weight ratio is markedly lower than B–52, which you would expect it to be. Then he comes back to commercials, one pound of thrust for each four, which does not really relate to a combat airplane.

Do you feel it is underpowered?

Colonel KENNY. Sir, the General Electric engines put out 30,000 pounds of thrust each. On a normal training mission where I am at 350,000 pounds, which is what I was referring to earlier when we discussed training downloaded, that give me at least a very good thrust to weight ratio, but I can take off in 4,000 feet, and I can be above 20,000 feet by the time I make my turn out of traffic at the field.

Senator GLENN. Well, OK, but you say that is downloaded to 350,000. Your maximum gross is, what, 477,000? It is right at half a million.

Colonel KENNY. We cannot achieve 477,000 unless we hang something externally on the aircraft. The operating weight is 180,000 pounds. I have 200,000 pounds of fuel internally, and so now anything other than that I have to put in the weapons bay. Beyond that, to get to 477,000 I have to hang something externally on the aircraft.

Senator GLENN. It would be an ALCM mission for 477,000?

Colonel KENNY. Yes, sir, and nobody has operated at that gross weight.

Senator GLENN. With full internal weight, what is the maximum gross you are operating at now?

Colonel KENNY. 410,000 is what the airplane on alert is operating at.

Senator GLENN. That would be maximum internal loading, conventional weaponry, which would be your heaviest loading, and full fuel?

General CHAIN. We need to go into that in classified session.

Senator GLENN. All right, fine. The next claim he had was that it is shortlegged. He said you cannot really get it with a full load. Well, let me read it here: It is shortlegged. The B–1s inherent problems yield some perverse results. With its high wing loading, the B–1 has to fly slightly nose high in order for its wings to generate enough lift. This technique creates higher induced drag.

The net effect of the B–1s various shortcomings is an aircraft unable to climb above 20,000 feet. It therefore must fly through denser air where jet engines burn more fuel. The overall penalty is an unrefueled range of at least 1,000 miles less than the B–52 according to the Air Force's own public assertions.

Someone over in the Pentagon is quoted as saying the B–1s will be suckling up to their tankers just as they cross the Soviet air space, asserts one Pentagon official, assuming the evil empire does not go after the tankers that now have to fly closer to Soviet borders.

What is your maximum altitude when you take off at maximum weight? What can you go up to at your cruise, and I presume you use a cruise climb beyond that for most efficiency. Are you that limited that you are a 20,000 foot airplane when you take off on a maximum cruise mission?

Colonel KENNY. All of our maximum altitudes are classified, sir. In other words, my optimum cruise and my top altitudes are classified.

Senator GLENN. All right, and the next claim he had was it does not fly well at the 200 foot mission, that since the wing loading is doubled, the turning maneuverability is cut roughly in half and is

unable to do what it is supposed to be able to do down low. I think you already answered that.

Colonel KENNY. The kindest word for that I think is hogwash.

Senator GLENN. OK, I will accept that.

The next claim is it does not work as advertised. It is quite a long section through his article, that extra weights made it tail-heavy, more likely to stall pulling up to go over hills. The stall inhibitor system he talks about a little bit. A computerized stability enhancement system will be added later as a further refinement. Is that correct?

General RANDOLPH. Yes, sir, that is correct.

Senator GLENN. If that is a better system, why are we not going to that now? We do not have it developed yet?

General RANDOLPH. Well, we are in the process of working that right now. This is a fly by wire system, Senator, that I mentioned to you, and it is using the latest technology.

Senator GLENN. OK. Do we know of any problems on the airplane now that cannot be fixed, because one of his points was that it cannot be fixed. There is no way of redressing the B-1s many shortcomings. Larger wings would reduce the wing loading, but they would impose a weight penalty of their own. The added cost would be horrific. Fuel tradeoff is bad. Some other things down through that article I am sure you read.

Are there any problems on the airplane right now that you see that cannot be fixed?

General RANDOLPH. Sir, I know of no problems that we do not believe that we can fix.

Senator GLENN. Are there any problems that cannot be fixed without large additional money?

General RANDOLPH. No, sir. The problems, as I said before, that we have, the problems in schedule, maturation, and that can be done within the $20.5 program.

General CHAIN. One additional comment, Senator. When you go through a litany like that of that stuff that Evans wrote, one can conclude that the airplane just has a lot of problems. The airplane does not have a lot of problems. It is the best warplane I have today. It is going to be an even better airplane tomorrow.

So when you add all of that up, we are just talking about things on the margin.

Senator GLENN. Well, your comments on the F-15 and F-16 were, I thought, very appropos earlier. On any new weapons system you are faced with a very major problem. You want to get out there and be there first with the most to give your own people the best advantage in combat if you get there. That means you are operating out here sometimes on the cutting edge of the art, and you are not always absolutely certain of things working out specifically as planned every time.

There has never been a new airplane that came along that did not require some development time, but what I have been concerned about is whether some of these things, like stability control problems, the interference with ECM and the offense/defensive difficulties between the avionics on the airplane might be something that really was going to prevent this airplane from doing the kind of mission that it was supposed to do.

You say there has to be some development in the ECM, partly because of original problems and partly because the threat analysis, the net assessment has changed somewhat. So that is something we could not have foreseen early on in the program.

I think that is all.

General CHAIN. If I could just comment on the Senator's last comment, I think the bottom line is these guys right here would rather go to war today in a B-1 than they would in a B-52, and I have great confidence that the guys flying the B-52 can do their wartime mission.

Senator EXON. Gentlemen, I thank you for being here. We will not go into closed session today. This subcommittee will be holding subsequent hearings on the whole strategic program, and we will go into some of the classified questions you were asked today.

I hope that we have laid to rest, at least to some extent this morning, the more irresponsible charges against the B-1B. I congratulate you for your forthcoming attitude. I guess that of all the things that have been said this morning, the thing that impressed me more than anything else was my first question today to the pilots operating the B-1B, that, if they had a choice for an aircraft to take on a penetrating mission to the Soviet Union tomorrow, they would choose the B-1B. You are the ones that are flying and that is good enough for me. I think those kinds of statements say a lot more than a lot of detailed briefings that we can receive on this.

I remember only a few years ago that the M-1 tank was under similar attack, and yet now the M-1 tank is the measuring device for all other combat tanks. Maybe the same thing will happen with the B-1.

Thank you very much.

Senator GLENN. Mr. Chairman, could I ask one more question?

Senator EXON. Thank you very much, Captain Strain and Major Elliott and Colonel Kenny and, of course, General Chain and General Randolph, for your excellent remarks, and I now yield to my colleague from Ohio for one additional question.

We have another Armed Services Committee meeting involving CINCs at 2 p.m. in room 222.

Senator GLENN. One very brief question. On dollars that you are going to request, and you are going to request $800 million, and that is to do testing on things that we could not foresee originally, is any of the rest of this $3 billion that Les Aspin talks about actually planned now?

General RANDOLPH. No, sir, it is not. By the way, it is $600 million for the baseline program, $200 million for the conventional capabilities that I have mentioned earlier, and that is a separate issue, and Congress needs to discuss and decide whether that is something that you will let us do.

The $600 million is for testing over 1988 and 1989, those 2 years, for the baseline program.

Senator GLENN. Do you see any deficiency on the airplane now that is going to require a big new request or a request for money at any level?

General RANDOLPH. Well, the answer is it depends on the testing, and that worst case number of $20.4 does include some additional

procurement money that might be needed, but right now I do not know of anything because we have not done the testing.

Senator GLENN. Outside of those variables, though, you are basically on schedule and at the prescribed price; is that correct?

General RANDOLPH. That is correct, yes, sir, and we expect to stay within the prescribed price. We do not see anything that will cause us to breach that $20.5 number, nothing.

Senator GLENN. Thank you all.

[Questions for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

B-1B FUEL LEAK

Senator LEVIN. Does the fact that the fuel leak problem is "fixed" mean that you don't need any money beyond what has already been authorized for the fuel leak problems?

General CHAIN. Additional money beyond that already authorized is not required to correct known fuel leak problems. However, approximately $2-3M in base level military construction money will be needed to upgrade the safety features in existing facilities to comply with current safety guidance for fuel tank entry. Besides fuel leak repair, we require entry for other reasons such as fuel probe removal and replacement. Without the upgrade, we are limited in the maintenance we can perform in these facilities.

B-1B MISSION CAPABILITIES

Senator LEVIN. Can the B-1 now carry out all of the missions originally contemplated for it with the same degree of effectiveness and safety as was originally planned and contracted for?

General CHAIN. The B-1 is our most effective penetrator and is a very safe aircraft. It met IOC requirements with the capabilities required for effective employment in today's war plans. Included within those capabilities is the ability to safely maintain the aircraft and substantial safety margins for the crews who fly this warplane.

B-1B PENETRATION CAPABILITY

Senator LEVIN. Does the B-1 have the penetrating capability that was originally planned for it? If it does not currently have such penetrating capability, how are you able to say that the B-1 can now carry out all of it's missions?

General CHAIN. Every B-1B is effectively planned for employment in the SIOP as a penetrator. It is important to understand that ECM is only one part of the penetration equation. Other aspects of B-1B performance—high speed, low radar cross section, and low altitude—have been considered in planning penetration routes. Even without ECM, the B-1B is a better penetrator than the B-52. As the ECM system matures, the B-1B will be even better.

GRAVITY BOMB VERSUS CRUISE MISSILE TARGETS

Senator LEVIN. What kind of target requires dropping a gravity bomb as opposed to destroying it with a cruise missile?

General CHAIN. Large yield weapons achieve a high level of damage against any target. Even with its exceptional accuracy, the small yield Air Launched Cruise Missile (ALCM) [deleted].

B-1B CONVENTIONAL CAPABILITIES

Senator LEVIN. Are any B-1s currently being equipped for conducting conventional bombing or missile attacks? If yes, how are they being equipped? If no, why not?

General CHAIN. B-1B conventional weapons testing is underway at Edwards AFB to support SAC's conventional capability. All B-1s will initially be capable of carrying Mark-82 and Mark-36 conventional weapons. Procurement of conventional support equipment and construction of munition preload facilities are in progress at Ellsworth AFB.

TECHNICAL PROBLEM AVOIDANCE WITH THE ATB

Senator LEVIN. What steps are being taken to avoid technical problems such as those found in the B–1 program in the ATB program?

General CHAIN. The Air Force is taking advantage of "lessons learned" on the B–1 program. In fact, the ATB Program Office is instituting a formal process with the contractor and the Strategic Air Command to insure a comprehensive, multi-discipline application of B–1 "lessons" to the ATB program.

Senator LEVIN. Is the ATB currently planned to be concurrently developed and procured?

General CHAIN. The ATB program is progressing well, the technology is well understood and working, and we expect the system to be operational in the early 1990s. Detailed development and procurement plans associated with the ATB program are specifically controlled under SPECIAL ACCESS REQUIRED procedures. Procedures have been established to provide this information through the committee staff.

AIRCRAFT REQUIREMENTS IN A "NO BALLISTIC MISSILE" SCENARIO

Senator LEVIN. In your testimony you told Senator Nunn that SAC had indeed begun to study the implications of a "no ballistic missiles" arms control agreement for our bomber and cruise missile forces. How many B–1Bs, ATBs, and ALCMs would we need to procure to meet the 1997 Soviet strategic defense threat without ballistic missiles and still deter Soviet aggression to your satisfaction?

General CHAIN. At the JCS's request, I have identified SAC's notional considerations on the impact of the potential zero ballistic missile (ZBM) environment. Certainly, if a ZMB agreement is achieved, the 1997 strategic force structure may require increased emphasis on bomber forces and cruise missiles. However, it is too soon to precisely define the strategic nuclear force structure required in a ZMB environment. To ensure that force structure options remain open, the first step we must take is to retain currently operational bombers. Second, we must continue with the nation's strategic modernization program since any 1996 force structure would be an outgrowth of that program.

BREAKOUT OF "WORST CASE" B–1 COSTS

Senator LEVIN. In your testimony before the committee you stated that your current "worst case analysis" of final B–1 costs showed a final cost of $20.4 billion fiscal year 1981 dollars. Does that figure include all funds for initial spares and military construction costs directly related to B–1 acquisition and deployment?

General RANDOLPH. Initial spares are included in the $20.5 billion (fiscal year 1981) certified baseline. Military construction costs are not included in that baseline.

B–1B TERRAIN FOLLOWING RADAR CAPABILITY

Senate LEVIN. You also stated that the Terrain Following Radar in the B–1 would be released for use on full automatic next month (March, 1987). Will that be at the originally specified 200 foot altitude, or at a higher altitude? If higher, when do you expect to be able to operate the B–1 on full automatic TFR at 200 feet?

General RANDOLPH. The Terrain Following Radar has been available for wartime use since IOC. It was released to Strategic Air Command for training at 500 feet in February 1987. The current automatic terrain following (TF) test series should be completed by the end of April 1987. Following this demonstration, the TF system will be released for operation at 200 feet.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

LIMITATIONS OF THE ECM SYSTEM

Senator THURMOND. Do the limitations of the ECM system affect the ability of the aircraft to carry out strategic missions against today's threat?

General CHAIN. No. There is no doubt it is capable of performing its strategic mission today. The B–1B is an effective manned penetrator because of total weapon system performance—high speed, low radar cross section, low altitude capability, and advanced countermeasures. The ECM system is providing important capabilities now and we expect it to improve as the system matures.

BASELINE ECM SYSTEM

Senator THURMOND. Will the baseline ECM system, when it meets contract specifications, permit the aircraft to carry out strategic missions in accordance with original plans?

General CHAIN. The B–1B can perform its strategic mission today and we are confident the baseline ECM system will meet its anticipated performance specifications.

AIRCRAFT PAYLOAD

Senator THURMOND. What can you tell us about the ability of the aircraft to satisfy its payload to range requirements?

General CHAIN. The B–1B can carry its assigned payload the required range and is effectively employed in the SIOP. Each B–1B that SAC owns has a designated SIOP mission.

B–1B CAPABILITIES

Senator THURMOND. As the operational commander, what capabilities do the B–1Bs now at Dyess provide that were not previously available?

General CHAIN. The B–1B has a lower radar cross section, a higher low level airspeed, and better low level capability than the B–52. Each B–1B has an assigned SIOP mission and has expanded targeting capability. Every B–1 is additive to a force structure that has remained constant for too long a period.

Senator EXON. Thank you very much. We are in recess, and we will convene at 2 in full committee.

[Whereupon, at 1 p.m., the subcommittee adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, FEBRUARY 26, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

NUCLEAR TESTING LIMITATIONS

The subcommittee met in open session, pursuant to notice, at 9:29 a.m., in room SR-222, Senate Russell Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Kennedy, Bingaman, Gore, Thurmond, Quayle, and Wilson.

Staff present: Carl M. Smith, staff director for the minority; Patrick A. Tucker, minority counsel; Robert G. Bell, Robert F. Bott, Judith A. Freedman, William E. Hoehn, Jr., Ronald P. Kelly, professional staff members; Colleen M. Getz, research assistant; Mickie J. Gordon and Kathleen L. McGuire, staff assistants.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Gregory B. Craig, assistant to Senator Kennedy; Donald A. Mitchell, assistant to Senator Glenn; Patricia J. Buckheit, assistant to Senator Glenn; Leon Fuerth, assistant to Senator Gore; Jim Sayer, assistant to Senator Wirth; William J. Wight, assistant to Senator Warner; Robert P. Savitt, assistant to Senator Cohen; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; George Tenet, Intelligence Committee.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. I will call the meeting to order.

I wish to officially apologize for the record for the mixup in my schedule. I have been, for the last half hour, over at the Commerce Committee at another meeting I was scheduled to attend. I assumed that that one started at 9 and this one started at 9:30. I apologize to the witnesses and I apologize to my friend, Strom Thurmond, for the delay.

Senator THURMOND. I know just how it is. I have four committees meeting this morning at the same time. So I can understand.

Senator EXON. This is a tremendously important meeting. I am going to start out with a rather short opening statement, and then I will recognize my friend, colleague, and co-worker, Senator Thurmond, who is equally interested in the subject matter of this very important hearing, which will last all day, as far as this Strategic Subcommittee is concerned.

The subcommittee meets today to consider the military implications of the two treaties limiting nuclear testing.

The Threshold Test Ban Treaty, signed by the United States and the Soviet Union in 1974, limited underground nuclear testing to 150 kilotons. The Peaceful Nuclear Explosions Treaty, signed in 1976, establishes a framework to govern underground nuclear tests for peaceful, nonmilitary reasons. It similarly limits explosive yields to 150 kilotons.

While neither treaty has been ratified by the United States or the Soviet Union, both nations have limited their nuclear tests to the 150 kiloton limit, or at least they are supposed to have limited them to that. That is one of the things that we will discuss here.

As a result of last year's congressional action on the Fiscal Year 1987 Defense Authorization Act, the President had agreed to submit both treaties for ratification and to pursue negotiations leading to a test ban. At that time, the administration and Congress reached an accord just prior to the Iceland Summit.

Since then, the issue has become more complex and confused, culminating in last week's confusing decision by the Committee on Foreign Relations to both submit the treaties for ratification and delay that ratification pending additional verification.

The Foreign Relations Committee is the committee of jurisdiction for these treaties. The purpose of today's hearing is not to repeat the work of that committee.

This subcommittee will not be voting on these treaties or a recommendation to the Senate. Instead, our efforts will be limited to the military implications of the 150 kiloton test limit, on the impact of the various means of verification.

It is my hope that we will build a record that members can refer to during our pending floor action of these treaties.

Nuclear testing is a complex issue. On the one hand, nuclear weapons invoke an instinctive response for us to do whatever we can to move away from reliance upon them. If further limits or a ban on nuclear testing would reduce the tension between the United States and the Soviet Union, certainly we would all agree that that would be good.

However, if all nuclear testing and our reliance upon nuclear weapons were ended by the treaties today, the world would still be a dangerous place. This is because the Soviet Union and its allies significantly outnumber ourselves and our allies in many important categories of conventional weaponry.

Conventional warfare itself has become ever more destructive, and differences between ourselves and the Soviets run deep, regardless of the existence of nuclear weapons.

In short, the consideration of reducing our reliance upon nuclear weapons also implies acceptance of responsibility to find alternative ways of insuring future national security.

It may be possible to find these alternatives, and I hope today's hearings will point the way, so that members can make the best informed decisions when these treaties come to the floor.

Our topic is complex, and our agenda today will be necessarily busy. Three panels of witnesses will testify, and today's proceedings will end with a classified briefing on U.S. nuclear monitoring capability.

I hope that the questions requiring a classified answer can be dealt with during that closed briefing, so that our panel session can be kept open to the public. However, if the majority of the members so desire, we can move to another room and continue our questions and answers in a closed session.

At this point, I would like to welcome the first of our witnesses today.

Our first panel consists of Dr. Robert B. Barker, Assistant to the Secretary of Defense for Atomic Energy; Lt. Gen. Dale A. Vesser, Director for Strategic Plans and Policy for the Joint Chiefs of Staff; and Adm. Sylvester R. Foley, Jr., Assistant Secretary for Defense Programs of the Department of Energy.

The second panel of representatives from our National Laboratories will testify immediately after our first panel. Then, after a break for lunch, a third panel of outside witnesses will testify.

While I will introduce these witnesses at the appropriate time, I would like to thank all of our witnesses in advance for appearing on such relatively short notice.

Senator Thurmond, I would like to recognize you now for any statement that you have before we call on the witnesses for testimony. In introducing Senator Thurmond, I introduce a very senior member of this Armed Services Committee, a very senior member of the United States Senate, who has had many years of working on the firing line with regard to peace, nuclear treaties, and the basic understanding of the overall defense posture of the United States of America and its allies.

Senator Thurmond.

Senator THURMOND. Thank you very much. I may be senior in age, but I'm young at heart.

Thank you, Mr. Chairman.

I commend you for holding these important hearings today on the Threshold Test Ban and Peaceful Nuclear Explosions Treaties.

I share your view that, while the Committee on Armed Services is not the committee with jurisdiction over these treaty matters, there are important military implications of the treaty limits and their verification.

I look forward to today's hearings to provide this important national security perspective.

Much has changed in our strategic posture since these treaties were first negotiated. In addition to significant changes in strategic nuclear forces, there have been equally significant changes in the targeting requirements that follow from our deterrence policy.

I believe that this committee must assure itself that the limitations of these treaties will continue to protect our national security interests in light of changes that have already occurred, and those that we anticipate.

Similarly, we need to understand the military significance of the current verification regime and what we can expect under the direct, on-site methods favored by the President.

Mr. Chairman, the action of the Foreign Relations Committee in reporting out two approaches to the ratification of these treaties, both apparently of equal merit, raises considerable uncertainty about the prospects of these treaties reaching the floor of the Senate. If they do, I expect that the debate is likely to focus more on the Senate's prerogatives in the ratification process than on the national security issues that we will be discussing today.

Nonetheless, these are important issues and today's hearings will be most helpful to us in conveying these issues to our colleagues.

Information conveyed today will also be useful in the authorization conference, which, again, promises to include limitations on nuclear testing.

Mr. Chairman, I join you in welcoming all of our witnesses today. Each of the panels offers unique and expert perspective on these issues. I thank you for the cooperation shown by you and your staff in accommodating the desires of this side in putting together the panels.

Finally, Mr. Chairman, I believe it is important that we conduct most of today's hearings in open session. However, I believe it is essential that a portion of the second panel's testimony, bearing on future requirements, be received in closed session. I understand that you are prepared to accommodate a closed session for that purpose.

I commend you for your fine leadership.

Senator EXON. I thank you very much, Senator Thurmond.

I want to tell you that if we need to go into closed session, as I indicated earlier, we certainly will.

Before I call on Dr. Barker, however, I would call on Senator Kennedy for a short opening statement.

Senator KENNEDY. Thank you, Mr. Chairman.

I, too, want to join in commending you and Senator Thurmond and the members of the staff for putting together today's hearing. In looking over those who will testify, the various panels, I think our committee will benefit from this expert testimony from a variety of different viewpoints.

I think the committee has done an excellent job in arranging for a variety in the presentations that will be made this morning and this afternoon.

Mr. Chairman, I am disturbed by this administration's approach to the nuclear testing issue. It's policy with respect to negotiations on a nuclear test ban has placed this Nation in a deplorable position of being in noncompliance with our treaty commitments to work for an end to nuclear testing. It is also illogical. The administration argues that a test ban must await "a time when we do not need to depend on nuclear deterrence to insure international security." But if we someday manage to satisfy this condition, why, at that point, would we even need a test ban?

Numerous administration witnesses have testified that continued testing of nuclear weapons makes possible reliance on fewer such weapons, thereby aiding the cause of arms reduction. But, if reliance on a smaller stockpile is so firmly linked to testing, why,

then, does the administration pledge that it will give up testing when we have achieved broad, deep, verifiable arms reductions?

I am similarly concerned about the administration's stance on verification of the Threshold Test Ban Treaty. Other countries wonder why the United States is willing to cooperate with the Soviet Union in the use of the highly intrusive CORRTEX device to verify continued testing at high levels, but not in the installation of less intrusive seismic networks that, unlike CORRTEX, would be useful in restricting tests to dramatically reduced levels.

The degree of improvement with CORRTEX is, under the best of circumstances, only marginally better than what might be obtained from a far more versatile, high frequency, in-country seismic network that the Soviet Union has already shown a willingness to accept as part of a low-yield Threshold Test Ban.

It seems to me the administration is counting on its CORRTEX proposal as a kind of "Tar Baby" for test ban negotiations, tying them up indefinitely and preventing the negotiations from reaching the second stage promised by the President in a letter to this committee on the eve of the Icelandic Summit.

ACDA, for example, recently reported to Congress that negotiating the technical and logistical details involved in the CORRTEX may be extremely time-consuming. All of this brings me to a question which I hope the panels will address: would the administration be willing to support an interpretation of the verification requirement in its reservation that allowed it to be satisfied by the use of CORRTEX to determine the yield of two calibration tests and by on-site configuration of the geological data to be exchanged under the treaty protocol?

This and other questions will be matters that I hope we will get from the various panels today.

I thank the Chair.

Senator EXON. Thank you, Senator.

Senator Bingaman has joined us.

Do you have any opening statement, Senator?

Senator BINGAMAN. I do not, Mr. Chairman.

I am looking forward to the testimony.

Senator EXON. Thank you.

I am pleased now to go right to our witnesses. We will start off with Dr. Robert B. Barker, Assistant to the Secretary of Defense for Atomic Energy.

Dr. Barker, we welcome you here. Please proceed.

STATEMENT OF HON. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY

Dr. BARKER. Thank you, Mr. Chairman, and Senators.

I am pleased to be here this morning to testify on behalf of the Department of Defense——

Senator THURMOND. Dr. Barker, the acoustics in this room are not too good. Please speak as loudly as you reasonably can and as close to the microphone as possible.

Senator EXON. Yes. Pull the microphone a bit closer, Dr. Barker. I think that will help.

Dr. BARKER. Does this do it?

Senator EXON. That's better.

Senator THURMOND. And keep your voice up.

Dr. BARKER. I will do so.

I am pleased to be here this morning to testify on behalf of the Department of Defense with respect to the President's submission to the Senate for its advice and consent the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty.

I would like your permission to submit my formal comments for the record, Mr. Chairman.

Senator EXON. Without objection, they will be fully entered into the record. If you could summarize them at this time, we would be pleased.

Dr. BARKER. I will indeed try to be brief in anticipation of your questions.

As you have already made reference, Mr. Chairman, on October 10 the President of the United States, in a public statement and in a submission of a letter to Senator Goldwater, who was then chairman of this committee, put on the record the United States Government's position with respect to the negotiation of limitations on nuclear testing.

He indicated at that time that the first order of business was, indeed, the ratification of the Threshold Test Ban Treaty and Peaceful Nuclear Explosions Treaty, once effective verification provisions had been negotiated with the Soviet Union. Immediately upon ratification of those two treaties, we would enter into negotiations with the Soviet Union on a step-by-step and parallel process of seeking nuclear test limitations in conjunction with the negotiation of reductions and the ultimate elimination of nuclear weapons.

We are here today to address the first part of that proposal, the first part of that sweeping agenda, which covers the spectrum from ratification of existing signed treaties ultimately to the achievement of a Comprehensive Test Ban Treaty.

The administration is committed to this process. The President is publicly on record endorsing it and has done so in a variety of fora, most recently in his letters to Senator Pell, to the Senate of the United States, in conjunction with submitting those two treaties, the Threshold Test Ban Treaty and the Peaceful Nuclear Explosion Treaty for advice and consent on the part of the Senate, with the understanding that they would not be ratified by the President until effective verification measures had been negotiated with the Soviet Union.

I recently came to the Defense Department. For the previous 3 years, I was with the Arms Control and Disarmament Agency. Last July, I had the privilege of being the head of the U.S. Technical Experts Delegation which has been discussing nuclear test issues with the Soviet Union.

We have met four times in the last months. We have met in July, September, November, and we met again in late January through early February. We are scheduled to go back again in March.

The administration is committed to the agenda that was outlined in the October statement. We have been trying, since July, in face-to-face technical discussions with the Soviets, to reach a common

understanding on the technical measures, by which we could effectively verify the Threshold Test Ban Treaties.

We have been adamant that the first step in any process to negotiate limitations on nuclear testing must be the achievement of effective verification provisions for the Threshold Test Ban Treaty.

Let me make a few comments on why we feel so strongly about the need for effective verification of those treaties; why it is so important to the Department of Defense.

The President, early in his administration, asked for an exhaustive study of the Threshold Test Ban Treaty and Peaceful Nuclear Explosion Treaty, and early in 1982, a determination was made that those treaties were not effectively verifiable as they had been negotiated.

The President asked his technical organizations, the Defense Department and the Department of Energy, to come up with a technical method by which the treaties could be effectively verified.

The President's conclusion had been that seismic techniques, which were the anticipated basis for verification of the Threshold Test Ban Treaty and Peaceful Nuclear Explosion Treaty, were accurate at best to a factor of two. This meant that if we received a signal that might nominally be associated with a 150 kiloton explosion, we had no way of knowing whether that explosion came from a source whose yield might be as low as 75 kilotons; that is 150 divided by two, or a yield as large as 300 kilotons, that is 150 kilotons times two.

The technical community responded with a technique known as CORRTEX, to which Senator Kennedy referred a moment ago. That technique, used as a verification tool, is capable of an accuracy of 30 percent—a substantial improvement over the gross inaccuracies of teleseismic techniques.

We tried, vainly, for several years to engage the Soviets in technical discussions with us. Finally, in July of last year, they agreed to technical discussions, and my team has spent many, many hours discussing these issues with the Soviet delegation.

The Soviets still will not agree to sit down and negotiate those verification improvements. I can, however, tell you that the Soviet delegation is very, very mindful of what goes on within the Congress of the United States. They continually ask questions about what the House is going to do; what the Senate is going to do; what their position is with respect to the position taken by the U.S. delegation.

I am convinced that the Soviet responsiveness to the requirements for improved verification to those treaties will be very strongly influenced by the action the Senate takes with respect to the President's request for advice and consent and ratification, subject to the negotiation of improved verification measures.

We have been adhering to the 150 kiloton limit of the Threshold Test Ban Treaty ever since 1976. It has not been without penalty.

It has imposed a burden on the national security posture of this country. It is an acceptable burden because the directors of the National Laboratories have told us—and they will have an opportunity to tell you again later this morning—that they believe they can provide adequate confidence in the reliability of our current nuclear weapons if they are permitted to test up to 150 kilotons.

But this approach does not provide the same reliability, not the same confidence, that we would have if we were able to test those weapons at full yield. I am sure this body is very well aware that we are today prepared to deploy weapons—the MX just recently deployed; the Trident II coming onstream; the small ICBM warhead. All of these systems will have yields in excess of 150 kilotons and we will be dependent upon certification for the reliability of those systems for tests whose yields do not exceed 150 kilotons. There can be no doubt that our confidence would be higher in those systems if we could test them at full yield.

So, we have paid a penalty. We have determined that it is an acceptable penalty. We need equal assurance that the Soviet Union is bound to the same degree as we are; that they are forced to accept the same risks that we accept with respect to nuclear warhead performance.

With today's situation of inadequate verification, we do not have that assurance.

Let me point out to you that a single test above the limit, if it means the difference between having confidence and not having confidence in a particular warhead, makes all the difference in the world.

A single test above 150 kilotons can be very, very significant in a military context. It can make the difference between the military commanders having confidence that the weapon will do what it is intended to and not having confidence in that same weapon.

But, over and above the debate and the discussions about the military significance, the military penalties, and the military risks, there is an arms control aspect to this whole issue.

There has been tremendous controversy about whether or not the Soviet Union has violated the Threshold Test Ban Treaty. The President concluded in his report of January 1984, that, although there were many ambiguities and a great deal of uncertainty, the Soviets had likely violated that Threshold Test Ban Treaty.

That was not a conclusion which has been universally accepted. There are many who criticize that decision.

That causes me to quote a statement made by Ambassador Warnke, who was then head of the Arms Control and Disarmament Agency when the Threshold Test Ban Treaty and Peaceful Nuclear Explosions Treaty were first presented to the Senate for its advice and consent in 1977.

During the 1977 hearings before the Senate Foreign Relations Committee, Ambassador Warnke was asked about effective verification. He, at that time said, and let me quote: "It seems to us that verification is absolutely essential when you are dealing with nuclear explosives, test bans, or limits, because, otherwise, you end up with a treaty which is a source of friction and controversy rather than one which is an improvement in bilateral relations and one which is genuinely effective."

What Ambassador Warnke was saying is the difference between a good treaty and a bad treaty is that a good treaty improves bilateral relations; a bad treaty is one which is a source of friction and controversy.

I submit that the inadequate verification of the Threshold Test Ban Treaty and the Peaceful Nuclear Explosion Treaty today is

indeed the source of controversy. It is the reason for the differences of opinions and the arguments about whether or not the Soviets have violated the treaty.

We need improved verification, not only because Soviet violations can constitute a military threat, but also we need improved verification solely to reduce the possibility of false alarms, to reduce the ambiguities that arise about compliance.

For both of those reasons, we have proposed to the Soviets the adoption of CORRTEX, a much more accurate system of determining yield. It is one which we are pursuing today, trying to get the Soviets to adopt. The Senate's endorsement of the need for effective and improved verification to those treaties is a very, very significant step toward our actually being able ultimately to ratify those treaties.

I thank you. That ends my comments.

[The prepared statement of Dr. Barker follows:]

PREPARED STATEMENT OF HON. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE [ATOMIC ENERGY]

Mr. Chairman, I am pleased to have this opportunity to present the views of the Department of Defense on the subject of the Threshold Test Ban Treaty (TTBT) and the Peaceful Nuclear Explosions Treaty (PNET).

Since 1976, the primary concern of the Department of Defense with respect to the TTBT and the PNET has been to ensure that these agreements place equal constraints on the nuclear weapon development programs of the U.S. and the Soviet Union. Such assurance requires that the agreements be effectively verified. The Department therefore fully supports the President's request for the Senate's advice and consent to the ratification of the TTBT and PNET, subject to the condition that the President shall not proceed with ratification until the U.S. and the Soviet Union have concluded additional protocols or agreements which would be integral parts of the treaties and which would provide for effective verification of the treaties, including the right of each side to conduct accurate, direct, hydrodynamic yield measurements at the site of all nuclear detonations of the other side which otherwise might appear to have yields in excess of 150 kilotons.

Perhaps, too little understanding exists as to why effective verification of these treaties is absolutely necessary. I therefore would like to focus my remarks today on this central question.

Arms control agreements are not an end unto themselves; along with necessary defense modernization programs, they are part of a mutually reinforcing approach to preserving Western security and increasing stability. Thus, the TTBT and PNET, like other aspects of arms control, must be judged in light of their contribution to our overall national security requirements and objectives, including a more peaceful and secure world.

Turning now to the treaties at issue, I must emphasize that the U.S. decision in 1976 to respect the 150-kiloton threshold of the as yet unratified TTBT has had an impact on our ability to meet essential defense requirements to ensure our national security. The TTBT has had this impact by limiting the flexibility of our nuclear testing program in ways that we otherwise would not have limited ourselves, given the incessant Soviet hardening program and their massive buildup in offensive and defensive capabilities since the TTBT was signed in 1974. Indeed, contrary to the expectations of some in the mid- to late-1970s, key Soviet military, leadership, and economic assets—which we must be able to hold at risk if deterrence and stability are to be maintained—are increasing significantly in hardness. Hence, the U.S. requirement for high-yield weapons has not diminished as some expected in the wake of the 1972 ABM Treaty and Interim Agreement on the Limitation of Strategic Offensive Arms.

Along with the continuing U.S. requirement for high-yield weapons comes a requirement to test these weapons at full yield to ensure the highest possible confidence in their reliability and effectiveness. But this area is where we have had to make trade-offs, where we have assumed certain risks and have been prevented from pursuing modern high-yield technologies in order to live within the TTBT regime.

Our last high-yield test took place in 1976—before the 150-kiloton TTBT limit took effect. This means that to accomplish our necessary defense modernization programs—including nuclear weapons for the Air Launched Cruise Missile, Peacekeeper missile, Trident submarine, B–1 bomber, and small ICBM—we have deployed, or will deploy, high-yield weapons without full-yield tests. Thus, with the passing years, we have been placed in the position of certifying that our newest weapons, which increasingly differ from their tested precursor, will still work as intended based upon the expert judgment of our weapon designers, and *not* upon validation by a full-yield test. In other words, our confidence that our weapons—which we must rely on for our nuclear deterrence well into the 21st century—will remain safe, effective, and reliable will not be as high as it would have been in the absence of the TTBT's constraints. This erosion of confidence will be compounded as the number of our superb weapon designers who have had direct experience with high-yield testing decreases over time.

Yes, we have accepted these risks. Yes, we believe we can meet all requirements for new high-yield weapons which we can now foresee. Yes, we have evaluated the risks and, on balance, they have been judged to be acceptable. We cannot guarantee, however, that this will forever be the case.

In this connection, I would note that Article V of the TTBT provides for a five-year duration with automatic extension for successive five-year periods, unless either party notifies the other of its termination no later than six months prior to the treaty's expiration at the end of a given five-year period. There also is a clause that protects our right to withdraw in the event of a threat to our supreme national interests. We must recognize, however, that exercising these clauses would require a consensus which, in fact, might be very difficult to achieve.

As I have indicated, acceptance of the constraints on our deterrent capabilities imposed by the 150-kiloton threshold requires that the Soviet weapons program is similarly constrained and that we have effective means to assess Soviet compliance or noncompliance with this threshold. If we do not provide for such means, if we leave the Soviets free to exploit verification uncertainties to carry out even a few nuclear weapon tests significantly above the 150-kiloton level, we would raise the inherent risks to U.S. security to unacceptable levels. We know from experience that even one nuclear weapon test can make the difference between having confidence or not having confidence in a stockpiled warhead. If the Soviets were to violate the 150-kiloton limit of the TTBT—and based on the totality of the evidence, seismic as well as nonseismic, we believe they likely have done so on a number of occasions—they could maintain high confidence in their existing high-yield designs, and better maintain and even improve the high-yield expertise of their nuclear weapon design and production establishment. In short, their confidence in their ability to strike our retaliatory forces could increase, to the detriment of the Free World. Even if we had assurance that the Soviets were complying with the 150-kiloton limit, it is possible that their approach to nuclear weapon design is such that the constraint may be less of a risk to them than it is to us.

I believe Senator Glenn very succinctly underscored the importance of effective verification during this Committee's hearings in 1977 on the TTBT and PNET. He then stated: "I will vote against anything around here that cannot be verified because I do not trust the people with whom we are dealing any more than does anyone else . . . As long as we make an agreement and know when they (the Soviets) violate it, then we are not in bad shape and we have made some progress. But just to take a 'pig-in-a-poke' assumption that they are going to abide by something because we abide by it is not realistic."

As President Reagan and others in the Administration repeatedly have stated, we cannot effectively verify Soviet compliance with the 150-kiloton limit of the TTBT and PNET without on-site, direct measurements. In their current forms, the treaties are a "pig-in-a-poke." The seismic techniques that we currently must rely on to estimate yields of Soviet nuclear detonations are assessed to have about a factor-of-two uncertainty for nuclear weapons tests, and an even greater uncertainty level for Soviet peaceful nuclear explosions. This uncertainty factor means, for example, that a Soviet test for which we estimate a yield of 150 kilotons may have, with 95 percent probability, an actual yield as high as 300 kilotons—twice the legal limit—or as low as 75 kilotons. And despite the optimistic predictions and efforts of seismologists over the years, they have no empirical data, no hard data on which to base their estimations of yields of Soviet nuclear detonations; they only have estimates built on extrapolations from tests and geological media far from the Soviet Union. Moreover, the seismic yield estimation process will always be subject to residual systematic errors unknown to us but known to, and possibly exploitable by, the Soviets. They could use their accurate knowledge of their geology and certain emplacement

techniques to systematically conduct nuclear tests in a manner that would reduce seismic signals—in effect, cloaking a nuclear test with a yield above the legal limit such that it appears to us as being within the limit.

Even if the verification measures now in the TTBT and PNET were implemented, the treaties still would not be effectively verifiable. The TTBT, for example, provides for an exchange of data, but does not provide for independent confirmation of the data by the U.S.

In 1981, when an eminent former member of this Committee learned of the factor-of-two uncertainty level in our estimates of Soviet nuclear weapon test yields and the question was raised whether we should ratify the treaties on this basis, his reaction was quick and correct: "Absolutely not." He encouraged us to look for a much improved verification means.

Well, we have found that better way—a method we have used to determine the yields of our own nuclear tests. Specifically, the U.S. CORRTEX system of direct, hydrodynamic yield measurement, when used directly to measure a Soviet nuclear detonation, will have a random error no larger than 30 percent, which corresponds to lowering the uncertainty factor from about 2 to 1.3. The practical, effective, and proven CORRTEX system would accomplish this sharply reduced uncertainty level without danger of compromising sensitive information about the nature or performance of the nuclear device whose yield is measured, and without the systematic-error uncertainties inherent in seismic methods.

We recognize that even CORRTEX will not eliminate all verification uncertainties. Its use, however, can significantly reduce those uncertainties. Its use can provide a timely basis for judgments on any Soviet violations, thereby enabling the U.S. to counter threats posed to our security. Of equal importance, CORRTEX-like measures will alleviate the situation which exists today, where the relationship between the U.S. and the Soviet Union is clouded by a constant exchange of demarches between our governments, each accusing the other of having violated the TTBT. For these reasons, direct, on-site, hydrodynamic yield measurements are indispensable to effective verification of compliance with the 150-kiloton limit of the TTBT and PNET. On this basis, the President has stated that if the Soviet Union were to agree to the use of CORRTEX to achieve effective verification of the treaties, he would be prepared to move forward on their ratification.

The U.S. has met with the Soviets on three separate occasions in 1986 at the Geneva Nuclear Testing Experts Meetings. I have been privileged to head the U.S. delegation. The U.S. objective throughout has been to establish effective verification of the TTBT and PNET. The U.S. has presented extensive technical briefings on CORRTEX to the Soviet experts. The technical interchange was significant. We also have reiterated the President's invitation to Soviet government experts to come to the U.S. test site, where they could observe CORRTEX in use on a U.S. nuclear weapon test and clear up any remaining questions. We have prepared the basis for the serious negotiation of the necessary verification improvements of the TTBT and PNET. We are continuing our efforts, however, to elicit a constructive Soviet approach. We note that shortly after the Reykjavik meeting, General Secretary Gorbachev indicated that the Soviet Union is ready to address "perhaps even on a top-priority basis," the TTBT and PNET treaties.

In conclusion, Mr. Chairman, I sincerely hope that the increased attention to nuclear testing issues over the past year or so, in both Congress and among the public, has led to a better appreciation of the direct and profound importance of these issues to the national security of the U.S. and our allies. As the Administration—beginning with President Reagan—has made clear, the maintenance of a strong nuclear deterrent has for four decades ensured the security of the Free World. As long as the U.S. and our allies must rely on nuclear weapons to deter Soviet aggression—and that will be the case for the foreseeable future—nuclear testing will be required to ensure the credibility of our deterrent. At the same time, I can assure you that the U.S. exercises all prudent restraint in the testing program. We test no more often than is necessary. And the U.S. test program has been consistent with our obligations under the TTBT.

This administration long has had a constructive and practical agenda in the area of limitations on nuclear testing, and the place to start is by introducing effective verification mechanisms into existing agreements—i.e., the TTBT and PNET. Without effective verification, we would incur unacceptable military risks and kindle suspicion and instability. With effective verification, we would lay the groundwork for mutual confidence in the agreements and, we hope, enhance stability. U.S.-Soviet agreement that provides for effective verification of the treaties is the necessary first step that would allow us, as the President has pledged, to ratify the treaties and then—in association with a program to reduce and ultimately eliminate all nu-

clear weapons—to engage in negotiations on ways to implement a step-by-step parallel program of limiting and ultimately ending nuclear testing.

We welcome congressional support for this agenda.

Thank you.

Senator EXON. Thank you, Dr. Barker. General Vesser.

STATEMENT OF LT. GEN. DALE A. VESSER, USA, DIRECTOR FOR STRATEGIC PLANS AND POLICY, ORGANIZATION OF THE JOINT CHIEFS OF STAFF

General VESSER. Mr. Chairman and members of the committee, I, too, am privileged to be here today.

I have submitted a statement for the record which outlines the military advice of the Chairman and the Joint Chiefs of Staff on the matters under your consideration today.

Rather than read that statement in its entirety, I ask that it be entered into the record.

Senator EXON. It will be entered into the record.

Please proceed.

General VESSER. Thank you.

I will summarize the views of the Chairman and the Joint Chiefs of Staff.

The Joint Chiefs of Staff have provided military advice to the Secretary of Defense and the President and to you for many years on nuclear treaty matters.

Last year, Admiral Crowe testified regarding these issues. Our advice and recommendations have been consistent.

The Joint Chiefs of Staff support the President's initiative in submitting the TTBT and PNET to the Senate for advice and consent, providing that appropriate modifications are adopted, which insure that our ability to deter attack on the United States and its allies is maintained and that the United States is not placed at a military disadvantage as a result of ratification.

These modifications fall into two general categories. First, improved verification measures must be incorporated into both treaties in some manner to assure compliance with the treaty provisions by the Soviet Union. Second, appropriate safeguards, including adequate verification, must be established to reduce associated military risks.

Let me elaborate on those two themes.

The United States signed, but did not formally ratify, the TTBT in 1974, and the PNET in 1976. Nevertheless, we have complied with the terms of the TTBT, with a resulting disadvantage to our deterrent posture.

As a result of compliance with the treaty, we have not explored advanced, high-yield technologies to improve the effectiveness of our weapons.

We have been unable to conduct full-yield confidence tests on some existing weapons. And, we have suffered a loss in qualified personnel, who have the ability to conduct such tests if the need should arise.

Senator THURMOND. General, pardon me for just a minute.

Mr. Chairman, the Veterans Affairs Committee is meeting to consider a lot of important legislation concerning veterans and they need me for a quorum. I will be back in 5 minutes.

Senator EXON. Thank you very much.

We appreciate your consideration.

Please continue, General.

General VESSER. While we were complying with the terms of the treaty, it appears likely that the Soviets have violated the 150 kiloton testing limit. But adequate verification of the terms of the treaty are not possible.

This is why the President has made effective verification of both treaties such a high priority.

It is essential that ratification of the treaties not take place until the President is able to certify to you that the treaties are, indeed, verifiable.

As you consider ratification of these two treaties, I would like to restate the position adopted by the Joint Chiefs of Staff regarding the need for adequate safeguards to assure our deterrent capability.

There must be provisions which permit testing consistent with treaty limitations. Testing enables us to insure that the weapons which provide us our deterrent capability are safe, and also enables us to achieve high confidence levels that all our weapon systems, both nuclear and conventional, will function effectively in a nuclear environment.

Testing enables us to maintain the credibility of our nuclear deterrent by assuring its effectiveness and reliability.

Finally, testing within the terms of the treaty insures that we will not be surprised by Soviet actions which might render our deterrent ineffective and alter the strategic balance.

In conjunction with adequate testing provisions, we must maintain modern nuclear laboratory facilities. The United States must have the capability to resume nuclear testing, which would be prohibited by these treaties if the actions of others make it necessary.

In addition to adequate verification programs previously mentioned, our Nation must continue its emphasis on maintaining adequate intelligence gathering capabilities.

Finally, there must be provisions for independent U.S. Governmental review at periodic intervals to determine if renewal of the treaties is in the best interest of the national security.

With the adoption of suitable verification measures being contemplated, and establishment of adequate safeguards which I will submit for the record, the Joint Chiefs of Staff support ratification of these treaties.

I appreciate this opportunity to appear before you on behalf of the Chairman and the Joint Chiefs of Staff to discuss these important issues.

This concludes my opening remarks.

[The prepared statement and Safeguards list of General Vesser follow:]

PREPARED STATEMENT OF LT. GEN. DALE A. VESSER, USA, DIRECTOR FOR STRATEGIC PLANS AND POLICY

Mr. Chairman and members of the committee,

I appreciate this opportunity to provide the views of the Joint Chiefs of Staff on the ratification of the Threshold Test Ban Treaty (TTBT) and the Peaceful Nuclear Explosions Treaty (PNET).

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The Chairman and the Joint Chiefs support, in principle, ratification of these treaties. That support, however, is with the understanding that the improved verification measures being contemplated are incorporated into the treaties as protocols or other appropriate codicils prior to ratification and that appropriate safeguards are adopted to reduce, in so far as possible, the military risks associated with these treaties.

The Limited Test Ban Treaty (LTBT) which was ratified in 1963 was the first step in limiting nuclear testing. That treaty prohibits testing in the atmosphere, in outer space and under water. Underground tests were also prohibited if those tests caused "radioactive debris to be present outside the territorial limits of the state under whose jurisdiction or control" the explosions were conducted.

While the LTBT was being negotiated the Joint Chiefs of Staff recognized that there were military risks associated with a treaty that restricted our flexibility in responding to changes in the threat we face. In order to reduce the associated military risks, the Joint Chiefs recommended safeguards which were subsequently adopted during the ratification process for the LTBT.

Following ratification of the Nuclear Non-proliferation Treaty (1968), United States representatives negotiated the TTBT (signed in 1974) and the PNET (signed in 1976). These treaties limit the yield of individual nuclear explosions to 150 kilotons. The provisions of the TTBT and PNET were undertaken to establish a comprehensive system of regulations which would govern all underground nuclear explosions, both those for weapons development purposes and those for peaceful applications.

During hearings on the TTBT and PNET before the Senate Foreign Relations Committee in 1977, the representative of the Joint Chiefs of Staff stated that the military risks associated with further constraints placed on U.S. nuclear testing by these treaties could be reduced to acceptable levels through adoption of appropriate safeguards. At that time the Chiefs believed that the appropriate safeguards could be arrived at through simple modifications to those safeguards adopted for the LTBT.

In reviewing the treaties for this set of hearings, the JCS have taken into account the experience of the ten years since the treaties were signed.

During those intervening years, it has become apparent that the treaties are not verifiable in their current form and that it was likely the Soviets have violated the 150 kiloton limit of the Threshold Test Ban Treaty. For this reason President Reagan made effective verification of the two treaties the highest priority in the area of nuclear testing limitation. The JCS fully support that priority and the President's initiative of submitting these treaties for advice and consent with a reservation to ensure that they are not ratified and do not take effect until he is able to certify that the U.S. and the Soviet Union have concluded additional protocols or other agreements, including provisions for direct, accurate yield measurements, so that the 150 kiloton limit of the treaties is effectively verifiable. Only through effective verification will the United States have confidence that the Soviets are being held as closely as possible to the same constraints that the United States has lived with since 1976.

While remaining in compliance with the terms of the Threshold Test Ban Treaty, the United States has been prevented from exploring advanced high yield technologies that would require testing above the 150 kiloton limit. The United States has also been unable to conduct full yield confidence tests of some stockpiled weapons. Likewise, during this period, the number of U.S. nuclear test and design personnel who have experience in high yield testing has declined, limiting our ability to test above 150 kilotons should a requirement arise.

Although our eventual goal is to reduce the number of nuclear weapons and our dependency on them for deterrence, the keystone of our deterrent strategy now, and for the foreseeable future, is the prevention of war by removing all incentives for aggression against the United States and our allies by promising a devastating retaliation to any attacker. We have endeavored to accomplish this goal for most of the postwar period by possessing a credible nuclear deterrent that is both effective and reliable. To maintain the credibility of this nuclear deterrent, testing is required. In addition, nuclear testing enables us to ensure that our nuclear weapons are safe, that both our nuclear and non-nuclear weapons and equipment would function in a nuclear environment, that we can keep ahead of Soviet efforts to neutralize our deterrent, and that the Soviets do not surprise us with breakthroughs which might alter the strategic balance. As these treaties are being reconsidered, the Joint Chiefs of Staff once again point out that it is imperative that appropriate safeguards be adopted to reduce the military risks associated with these treaties. In support of this objective, the JCS forwarded, with a request that they be included in the ratifi-

cation process, a revision of the safeguards adopted in conjunction with the Limited Test Ban Treaty. This revision includes continued underground nuclear test programs consistent with treaty limitations, maintenance of modern nuclear laboratory facilities, maintenance of the basic capability to resume nuclear tests in prohibited environments and yield ranges, should they be considered essential, a vigorous verification program, and continued emphasis on intelligence capabilities.

Furthermore, because adherence to the 150 kiloton limit of the threshold test ban treaty constrains our ability to respond to changes in the Soviet threat, the revision of the LTBT safeguards calls for the conduct of an independent U.S. Governmental review at periodic intervals to determine if renewal of the treaties is in the U.S. national interest. The Joint Chiefs of Staff have added this provision because although the United States has been able to meet the Soviet threat while remaining in compliance with the constraints of the Threshold Test Ban Treaty, and will be able to do so for the current modernization program, we can not preclude the possibility that Soviet efforts to subvert our deterrent may create a situation that requires the United States to test above the 150 kiloton limit.

In summary, I believe that with the additional verification measures being contemplated and adoption of adequate safeguards, ratification of the treaties would be supportable by the Joint Chiefs of Staff.

SAFEGUARDS

Now and for the foreseeable future, our nuclear weapons stockpile plays a prominent role in our national security posture. As long as this is the case, we must safeguard the efficacy of that stockpile and our confidence in it. These safeguards are considered an essential element in ensuring the nation's ability to have the technical means and knowledge necessary to support the nuclear deterrent and existing and future national security policy.

Safeguard "A": The conduct, within the constraints of existing treaties on nuclear testing, of comprehensive, aggressive, and continuing underground nuclear test programs designed to add to our knowledge and improve our weapons in all areas of significance to our military posture for the future.[1]

Safeguard "B": The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology which will attract, retain, and ensure the continued application of our human scientific resources to those programs on which continued progress in nuclear technology depends.

Safeguard "C": The maintenance of the basic capability to resume nuclear test programs, in prohibited environments; and to conduct testing promptly in prohibited yield ranges.

Safeguard "D": In conjunction with a vigorous verification program, the conduct of a comprehensive, and continuing research and development program to improve our monitoring capabilities and operations with a goal of providing high confidence monitoring of those actions from which non-compliance with existing nuclear testing treaties could be inferred.

Safeguard "E": The continuing development of a broad range of intelligence gathering and analytical capabilities and operations to improve our knowledge of the nuclear arsenals, nuclear weapons development programs, related nuclear programs, and the capabilities and achievements of the Soviet Union and other nations.

Safeguard "F": The conduct of a governmental review at periodic intervals to determine whether the provisions of existing treaties on nuclear testing remain consistent with U.S. national security interests.

Senator EXON. Thank you very much. We appreciate your statement.

We will go to questions in just a few moments.

Next we will call on Adm. Sylvester R. Foley, the Assistant Secretary for Defense Programs for the Department of Energy.

Secretary Foley, welcome to you.

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[1] (U) For the purpose of Safeguard "A", the underground nuclear test programs shall include, but not be limited to, tests sufficient to insure that our nuclear forces and their supporting command, communications and intelligence systems are safe, secure, effective, reliable and survivable, and to advance our understanding of nuclear-weapon effects.

STATEMENT OF HON. SYLVESTER R. FOLEY, JR., ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

Admiral FOLEY. Thank you very much, Mr. Chairman, and thank you for the opportunity to share my views on this important issue with this committee.

I would like to insert for the record a DOE policy paper, the title of which is "Nuclear Weapons Testing."

Senator EXON. Without objection, it will be inserted.

[The information referred to follows:]

Policy Paper 5

Nuclear Weapons Testing

January 1987

U.S. Department of Energy

"While we are actively investigating technologies that may one day make us less dependent on offensive nuclear weapons for our security, nuclear weapons will remain for the foreseeable future the key element of our deterrent. In such a situation, where both the U.S. and our allies must rely upon nuclear weapons to deter aggression, nuclear testing will continue to be required."

President Reagan - letter to Non-Aligned Group of Six, March 12, 1986

"A comprehensive test ban remains a long term objective of the United States. We believe such a ban must be viewed in the context of a time when we do not need to depend on nuclear deterrence to ensure international security and stability and when we have achieved broad, deep and verifiable arms reductions, substantially improved verification capabilities, expanded confidence building measures, and greater balance in conventional forces."

President Reagan - letter to U.S. Allies, March 14, 1986

Overview - Why We Need Nuclear Tests

- Our security and that of the Free World depend on deterrence.
- For deterrence to work, potential aggressors must be convinced that we have the capability and the will to deliver a devastating response to attack on us or on our allies.
- U.S. nuclear weapons are an essential part of deterrence.
- Nuclear weapons must be tested to remain safe, reliable, effective, and survivable.

The Historical Role of Nuclear Weaponry

- Nuclear deterrence was established as a postwar counter to Soviet land armies.
  - — No massive U.S. armies or large draft
  - — Limited NATO commitments
- Deterrence has been successful in holding down U.S. defense expenditures.
  - — 1955: Defense Budget = 11.2% of GNP
    Defense Budget = 62.4% of Federal Budget
  - — 1985: Defense Budget = 6.6% of GNP
    Defense Budget = 26.5% of Federal Budget

The decision was made early in the postwar era that the United States and its European allies would not attempt to match the huge land armies of the Soviet Union. Nuclear weapons have been used to augment NATO forces, but their primary role has always been to deter Soviet attack. The strategy has been successful, and (for example) has let the U.S. keep the peace without relying on large armies or on a military draft for the last decade. Without conventional disarmament, weakening our nuclear deterrent could "make the world safe for conventional war."

Nuclear deterrence has also let the U.S. hold down its military expenditures. Contrary to the belief held by many, U.S. military spending as a fraction of gross national product is only about half as much today as during a similar period of peace and prosperity 30 years ago.

Nuclear Testing is Essential to U.S. Security

- It is essential to ensure stockpile reliability.
- It is essential to modernize our nuclear weapons systems in response to changing threats and to include the most modern safety and security devices.
- It is essential to ensure that our weapon systems are invulnerable to nuclear effects.
- It is essential to avoid technological surprise by an adversary.

Testing is required to ensure the safety and reliability of any complex system. We would not dream of flying in an airplane that had not been tested. Yet, some would ask us to have confidence in our nuclear weapons, some of the most complex mechanisms in existence today, without testing.

Here are four specific reasons why we need to test our nuclear weapons:

First, we need to test to maintain our confidence in the reliability of weapons that are in stockpile. In the past, there have been reliability problems where underground nuclear tests were necessary to find the problem and to confirm that the repair worked. Without nuclear testing, we would lose confidence in our deterrent.

Second, nuclear testing is essential for the development of safe, secure and effective warheads for the new weapons systems necessary to counter the changing Soviet threat.

Third, we need to conduct nuclear tests to ensure that our weapons systems can survive the nuclear effects of enemy nuclear warheads.

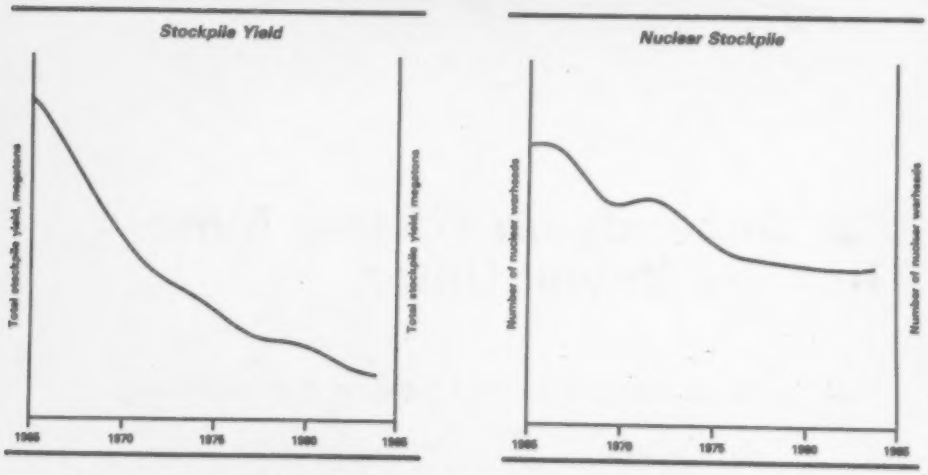
Finally, nuclear testing is essential to keep abreast of possible Soviet nuclear weapons developments and to avoid any technological surprises. We test neither more often nor at levels higher than necessary to meet our security requirements.

U.S. Depends on Testing More Than the Soviet Union

- U.S. warhead designs depend more on high technology.
- Lower U.S. missile throw-weight needs optimized warheads.
- U.S. demands higher safety and security standards than Soviets.

Nuclear testing is probably more important to the U.S. than to the Soviet Union. Based on available evidence, the U.S. relies more on high technology and on optimized warhead characteristics in our nuclear warhead designs. In a testing environment more limited than currently, Soviet missile throw-weight and volume advantages would allow the Soviets to more easily rely on previously tested, heavier, higher yield, simple warhead designs. Moreover, American standards of safety for nuclear weapons are almost certainly higher than those the Soviet Union imposes. These higher standards require more testing to verify that the implementation of them does not interfere with operation of the warheads. The U.S. goes to great lengths in warhead design to preclude not only unauthorized detonations, but also any dispersal of radioactive material in case of an accident. All of these goals, specific to the American value system, lead to a greater U.S. reliance on nuclear testing.

TESTING HAS ALLOWED REDUCTIONS IN THE U.S. STOCKPILE



Source: Presentation of Secretary of Defense Weinberger to Senate Armed Services Committee in *Hearings: Department of Defense Authorization for Appropriations for Fiscal Year 1985*, 1984, pt. 1, p. 123.

Contrary to the assertions of some, the U.S. nuclear weapons program, of which testing is but one part, has not led to an ever larger stockpile, with greater total destructive force. In no small measure, thanks to innovations and improvements made possible by testing, we have been able to introduce newer, safer and more effective systems while actually significantly reducing the number of weapons in our nuclear arsenal from what we had 20 years ago. The number of weapons in the U.S. nuclear stockpile was about one-third higher in 1967 than it is today. Moreover, our arsenal today has one quarter the explosive force we fielded two decades earlier.

Verification is Still a Problem

- Teleseismic detection and identification of low yield tests cannot be relied on.

- Soviets could test in underground cavities.
  - — To try to conceal low yield tests
  - — To interfere with seismic yield estimation

- Testing also could be done by the Soviets in deep space or remote areas of the world.

Seismic monitoring from remote stations — the only verification means currently available to us for monitoring underground testing — is not sufficiently sensitive to detect and identify small tests, much less to estimate their yields.

Detonating weapons in underground cavities "decouples" the blast from the surrounding earth and greatly complicates the verification problem. Sufficiently small tests might be totally undetectable, while larger ones would appear to have lower yield than is actually the case.

There is virtually no limit to the size of a test that could be concealed in very deep space, a strategy with little attraction today (when 150 kiloton tests can be done legally underground), but one which might have much more appeal in the presence of a comprehensive or low-yield threshold test ban.

It is true that substantial improvements have been made in verification technology. But many problems remain, as do the national security concerns that would make a test ban undesirable today, even in the presence of the very best verification.

Historical Experience with a Nuclear Test Moratorium

- The 1958-1961 moratorium demonstrates the dangers and unacceptability of such an approach.
  - — Reliability problems, in some cases outright failures
  - — The Soviet breakout

The U.S. does not believe that a testing moratorium is a prudent, effective, or constructive step toward our goal of a safer world. A look back at the 1958-61 testing moratorium demonstrates why the U.S. believes that moratoria are never acceptable substitutes for negotiated, equitable, and effectively verifiable arms control agreements. Certain warheads introduced during the moratorium were subsequently found to have design flaws that, if they had not been detected and corrected through testing, would have had catastrophic effects on our deterrent. And we should never forget that the Soviets used the time of the moratorium to design new atmospheric experiments and to develop a plan for their execution. Then they resumed testing with what is still today the most intensive series of nuclear tests in history. Because our technical base degraded sharply during those years without testing, it took us nearly a year and a tremendous effort to restore our previous capabilities. As President Kennedy warned at the time:

> *"Some may urge us to try it (a moratorium) again, keeping our preparations to test in a constant state of readiness. But in actual practice, particularly in a society of free choice, we cannot keep topflight scientists concentrating on the preparation of an experiment which may or may not take place on an uncertain date in the future. Nor can large technical laboratories be kept fully alert on a standby basis waiting for some other nation to break an agreement. This is not merely difficult or inconvenient — we have explored this alternative thoroughly, and found it impossible of execution."*

3/2/62 Address to the American People

A Test Ban At This Time - Not the Route to Peace

- A test ban is not arms control.
  - — No reduction of existing nuclear arms
  - — No reduction in the non-nuclear threat
- A test ban could lead to instability.
  - — Weakens this country's deterrence
  - — Can tempt the other side into aggression
- Weakened deterrence is a threat to world peace.

A nuclear test ban is not arms control, nor is it a step in the direction of any arms limitation that would enhance the safety of this or other countries. Not one of the nuclear, chemical, or conventional weapons that threaten us today would be eliminated by a test ban. Rather, a test ban would simply deny this country the ability to maintain and modernize its nuclear forces. Loss of that ability would undermine the deterrence on which the security of the Western World depends; it would be a form of unilateral disarmament.

This erosion of American strength could have the effect of tempting enemies, currently deterred by our nuclear forces, to threaten Western security through direct coercion, or indirectly through continued encroachment such as has occurred in Afghanistan. Thus, contrary to the arguments of its proponents, a nuclear test ban at the present time would not serve the cause of peace. In reality, it might even be a threat to peace.

Some Frequently Asked Questions

The Soviet Union Stopped Nuclear Testing For Over A Year. Why Can't We?

Continued nuclear testing is essential to the maintenance of our nuclear deterrent, which is the ultimate guarantor of U.S. and allied security. While we conduct nuclear testing neither more frequently nor at yields higher than absolutely necessary to meet our security needs, our decisions must be based on those needs and not on the actions that may or may not be taken by another country.

In fact, nuclear testing appears to be more important to the U.S. than to the Soviet Union. American standards of safety for nuclear weapons are almost certainly higher than those required by the Soviets. Differences in our force structure also contribute to our assessment that the U.S. relies more on high technology and optimized warhead characteristics than do the Soviets; in a no-test environment, for example, the Soviet missile throw-weight and volume advantages could permit them to fall back on previously tested, heavier, and relatively simpler warhead designs. Moreover, in a no-test environment leading to the erosion of the credibility of the U.S. nuclear deterrent, Soviet advantages in conventional and chemical forces unrestrained by any testing limitation would be magnified — with a resultant deterioration of Western security.

Will We Have To Keep On Testing Nuclear Weapons Indefinitely?

A comprehensive test ban remains a long-term objective of the United States. While we are actively investigating technologies that could one day reduce and ultimately eliminate our dependence on nuclear arms for our security, nuclear weapons will remain the key element of deterrence for the foreseeable future. During such a period, where both the United States and our friends and allies must rely upon nuclear weapons to deter aggression, nuclear testing will continue to be required.

Don't We Already Have More Weapons Than We Need For Deterrence?

The ultimate U.S. long-term objective is the eventual complete elimination of nuclear weapons. As a step in that direction, we are negotiating with the Soviet Union in Geneva for substantial, stabilizing and verifiable reductions in both strategic and intermediate-range nuclear forces, and we hope the Soviet Union will negotiate seriously toward this objective.

At the same time, it is important that we maintain an adequate nuclear deterrent. Many of our current nuclear weapons are aging and becoming increasingly vulnerable as a result of the massive Soviet buildup and relative U.S. restraint during the last 15 years. Our objective, embodied in the President's strategic modernization program, is not to increase the number of weapons, but to replace aging weapon systems with newer ones that can continue to deter effectively. If we do not take these steps to modernize now, the Soviet Union will have little incentive to negotiate for the significant reductions we are proposing in Geneva.

Can't Supercomputers Do The Analysis That Makes It Unnecessary To Test?

No. A nuclear explosion is an extraordinarily complicated physical process, and one which is not fully understood even by the most expert scientists. The complexity of the physical processes involved requires that we make many approximations in the calculations. It is true that our scientists rely on and use supercomputers heavily in the design process. However, even with all that capability, we have frequently found significant differences between computer predictions and the actual results of nuclear tests. Deterrence requires that we pose a credible retaliatory capability to any prospective adversary — i.e., a capability requiring real, effective weapons, based on careful computer design and adequate nuclear tests.

Wouldn't A Test Ban Slow The Soviet Union Down Just As Much As Us?

The U.S. and the Soviets have different target sets: the Soviets have invested heavily in hardening their targets, while we have not. To hold those important Soviet assets at risk without unacceptably high levels of collateral damage, we must optimize the yield-to-weight ratio of our warheads. Because of this, nuclear testing appears to be more important to the U.S. than to the Soviet Union. Based on available evidence, we think that we rely more on high technology and on optimized warhead characteristics in our nuclear warhead design than do the Soviets. In a no-test environment, Soviet missile throw-weight and volume advantages could permit the Soviets to fall back on previously tested, heavier, and relatively simpler warhead designs, which generally should be more reliable and rugged.

With Modern Technology, Can't We Keep Them From Cheating On A Test Ban?

No. We cannot even tell with certainty whether they are complying with the existing 150-kiloton limit on testing. If the limit were lowered, we could be sure only that the verification problems would be worse. Even small violations of a comprehensive or low yield threshold test ban could be very important if we ourselves were doing little or no testing. Furthermore, violations need not be so small. Testing at high yield, undetectably, in deep outer space is an option that makes little economic sense today; but it is a possibility that might be very attractive to the Soviet Union if a comprehensive or low-yield test ban were in place.

If We Stopped Testing And Found Ourselves Falling Behind Militarily, Couldn't We Just Start Up Again?

Not without great difficulty and delay. An example of this kind of expectation is our experience at the end of the 1958-61 informal moratorium when the Soviets resumed testing with what is still today the most intensive series of nuclear tests in history. Because our technical base degraded sharply during those years without testing, it took us nearly a year and an extraordinary effort to restore our previous capability to perform militarily significant nuclear tests. The effect of a long-term comprehensive test ban would be much more severe. In our country, in contrast to the practice in the Soviet Union, nuclear weapons scientists could move into more promising careers; test facilities would fall into disrepair; annual appropriations would be committed to other programs. President Kennedy in 1962 recognized that this option "is not merely difficult or inconvenient — we have explored this alternative thoroughly, and found it impossible of execution."

Why Are The Soviets Pushing So Hard For A Test Ban?

We are under no illusions as to the purpose that the Soviet authorities hope their test ban campaign will serve: to confuse further the domestic debate about the need for American nuclear testing. The Soviets also would have much to gain from a test ban:

- Differences in our force structure and weapons characteristics make the Soviets less dependent on testing.
- We have much more stringent safety and security standards than the Soviets, and hence need more tests to ensure that these standards do not lead to inoperable weapons.
- The U.S. respects its international commitments; the Soviets have the capability, motive, and demonstrated willingness to violate such obligations, including agreed limitations on nuclear testing, thus gaining unilateral advantages.
- Even if our confidence in our respective nuclear forces were to erode in a similar fashion — and this is very unlikely — Soviet advantages in conventional and chemical forces would lead to a net deterioration of Western security.

How Much Could The Yield Limits Of Nuclear Tests Be Reduced Without Significantly Hurting Our Weapons Program?

The U.S. tests neither more frequently nor at levels higher than is absolutely necessary to meet our security requirements. We must retain the flexibility to adjust our testing to respond to changes in the Soviet threat and to ensure that our weapons remain safe and effective.

There is no "magic" yield level above which tests are not needed. With today's 150-kiloton limit, we have already restricted our program considerably: we can no longer conduct tests of most strategic weapons at full yield. To some extent, weapon performance can be extrapolated from partial-yield tests, but as the range of extrapolation increases, our confidence in weapon performance decreases.

Only by testing at yields up to 150 kilotons are we able to validate performance of the fusion stage of many strategic weapons. As threshold levels decrease, it eventually becomes impossible even to test the fission or "trigger" stages. Nuclear effects tests (to study and overcome vulnerabilities to enemy countermeasures) and weapon physics tests may range from less than a kiloton to many kilotons, depending on the particular phenomena being studied. We believe that the reduced confidence in our nuclear deterrent which would result from the elimination of such necessary testing would be unacceptable.

Wouldn't A Test Ban At Least Be A Step In The Direction Of Meaningful Arms Control?

Our priority is and must remain the goal of deep, equitable, and effectively verifiable reductions in Soviet and American nuclear weapons. A test ban would be inequitable, undesirable, and unverifiable, and would not reduce existing arsenals by a single weapon. Indeed, a test ban might well lead to an increase in force levels as confidence is lost in the existing stockpile. In short, a test ban would set back, not help, our efforts to achieve real reductions.

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Admiral FOLEY. Thank you, sir.

The Department of Energy supports the President's proposal to ratify the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty. These treaties, if coupled with effective verification, represent a step toward the goal of arms control between the Soviet Union and the United States.

Now, since these treaties were signed in 1974 and 1976, there has been considerable doubt concerning Soviet compliance with the 150 kiloton yield limit of the Threshold Treaty. Dr. Barker covered this at some length in his statement.

Because of inadequate treaty verification capability, the Department of Energy, along with other government agencies, has worked diligently to improve our national technical means of verification, specifically teleseismic measurement.

The presently employed teleseismic monitoring techniques which rely on measurements taken many hundreds of miles from the sites of Soviet nuclear explosions result in a large measure of uncertainty in our ability to verify Soviet compliance.

Recognizing the critical need for a better verification method, the DOE laboratories—and you will have a chance to talk to the lab directors themselves a little later, sir—have developed a direct, accurate, on-site, hydrodynamic yield measurement technique, called CORRTEX.

This technique would reduce the uncertainty in yield measurement of the Soviet nuclear explosions by a factor of about three. Dr. Barker again explained how we stand right now in teleseismic, and we can improve the accuracy clearly from about a factor of two down to a factor of three, that is, down to about 1.3, rather than a 100 percent error.

This increased accuracy would lower the upper limit of yield measurement from 300 kilotons down to about 195 kilotons, thus significantly reducing the military advantage of possible cheating.

The on-site presence of U.S. and Soviet technicians would also reduce the possibilities of cheating and would increase the confidence of both sides in treaty compliance.

During the 11 years that these treaties have awaited ratification, the United States has complied fully with their provisions. The 150 kiloton limit has constrained our capability to address the full range of developing Soviet threats, and a number of nuclear tests have been precluded by our observance of the yield limit. We have been unable to perform full yield tests of many weapons to meet our current security requirements and for advanced concept tests to improve or advance our high-yield technology base. Even full-yield stockpile confidence tests have been precluded.

Full-yield tests of the warheads, again, for the Peacekeeper and the Trident II missiles, have not been possible. We have, therefore, taken a very conservative approach in the development of warheads for these systems. They had to be based on already previously tested concepts and components.

Development of new, high-yield technology has been curtailed. Nevertheless, we have been able to meet most of our military requirements for high-yield weapons during the past 11 years because of our inventory of already tested designs. We are depending on things and designs that are at least 10 years old.

But, for existing and new weapons, we have, one, improved their safety; two, we have increased their survivability; we have improved the command and control; and we have maintained the reliability of our weapons.

Now, the President has pledged to ratify these two treaties and then to proceed with a parallel program to reduce and ultimately eliminate both nuclear weapons and nuclear testing.

I wish to emphasize that further test restraints alone will not achieve these goals.

Further limitations on testing will not subtract one single weapon from the arsenals of either side. What is needed is mutual, verifiable arms reductions, including achievement of better balance in conventional arms.

Ratification of these treaties with improved verification would be a significant confidence-building step toward this goal. The Department of Energy supports these efforts and encourages the Senate to assure that no further testing restraints are mandated before appropriate arms reductions are in place.

Now, the Joint Chiefs of Staff has recommended that appropriate safeguards be adopted, similar to those that accompany the limited Test Ban Treaty of 1963, to reduce the military risk associated with these treaties. These safeguards would include continued underground testing consistent with treaty limitations; maintenance of modern nuclear laboratory facilities, along with a capable scientific staff; maintenance of the basic capability to resume nuclear tests in the prohibited environments and yield ranges should they become vital to U.S. national security; a vigorous verification program and continued emphasis on intelligence activities and a periodic review to determine if renewal of the treaties is in the U.S. national interest.

The Department of Energy endorses these safeguards and encourages the Senate to give them serious consideration as part of the ratification process.

The President's letter to the Senate Armed Services Committee of October 1986, requests that the Senate condition its advice and consent to the ratification of these treaties on the conclusion of additional protocols or other agreements with the Soviet Union that would make them effectively verifiable by providing for direct, accurate yield measurements taken at the site of all appropriate nuclear detonations.

The on-site CORRTEX hydrodynamic yield measurement technique, with its supporting arrangements, can provide the capability necessary to improve the verification of these treaties and to alleviate the mutual suspicions and challenges that have occurred over the past decade, due largely to the inadequacy of national technical verification methods.

I encourage the Senate to adopt this reservation.

In conclusion, I recommend the ratification of these treaties with the reservation requiring effective verification, as recommended by the President.

Thank you very much, Mr. Chairman.

[The prepared statement of Admiral Foley follows:]

Prepared Testimony of Adm. S. R. Foley, Jr., Assistant Secretary for Defense Programs, Department of Energy

Mr. Chairman, thank you for the opportunity to share my views on this most important issue with the committee. I would like to insert for the record a DOE policy paper titled Nuclear Weapons Testing.

SUPPORT FOR RATIFICATION

The Department of Energy supports the President's proposal to ratify the Threshold Test Ban Treaty and the Peaceful Nuclear Explosions Treaty. These Treaties, if coupled with the effective verification, are a step toward the goal of arms control between the Soviet Union and the United States.

Since these Treaties were signed in 1974 and 1976, there has been considerable doubt concerning Soviet compliance with the 150 kiloton yield limit of the Threshold Treaty. Because of inadequate Treaty verification capability, the Department of Energy, along with other U.S. Government agencies, has worked diligently to improve our National Technical Means of verification, specifically teleseismic measurement. The presently employed teleseismic monitoring techniques, which rely on measurements taken many hundreds of miles from the sites of Soviet nuclear explosions, result in a large measure of uncertainty in our ability to verify Soviet compliance.

Recognizing the critical need for a better verification method, the DOE laboratories have developed a direct, accurate, on-site hydrodynamic yield measurement technique called "CORRTEX." This technique would reduce the uncertainty in yield measurements of Soviet nuclear explosions by a factor of three. The increased accuracy of CORRTEX would lower the upper limit of yield measurement ambiguity from about 300 kilotons to about 195 kilotons, thus significantly reducing the military advantage of possible cheating. The on-site presence of U.S. and Soviet technicians would also tend to reduce the possibilities of cheating and would increase the confidence of both sides in treaty compliance.

U.S. COMPLIANCE

During the eleven years that these Treaties have awaited ratification, the United States has complied fully with their provisions. The 150 kiloton limit has constrained our capability to address the full range of developing Soviet threats and a number of nuclear tests have been precluded by our observance of the yield limit. We have been unable to perform full-yield tests of many weapons to meet our current security requirements, advanced concept tests to advance our high yield technology base, and full-yield stockpile confidence tests. Full-yield tests of warheads for the Peacekeeper and Trident II missiles have not been possible. We have therefore taken a conservative approach in the development of warheads for these systems, based on tested concepts and components. Development of new high yield technology has been curtailed. Nevertheless we have been able to meet most of our military requirements for high-yield weapons during the past 11 years because of our inventory of already tested designs. For existing and new weapon systems, we have: improved their safety; increased their survivability; improved their command and control; and maintained their reliability.

PARALLEL ARMS REDUCTION PROGRAM

The President has pledged to ratify these Treaties and then to proceed with a parallel program to reduce and ultimately eliminate both nuclear weapons and nuclear testing. I wish to emphasize that further test restraints alone will not achieve these goals. Further limitations on testing will not subtract a single weapon from the arsenals of either side. What is needed is mutual, verifiable arms reductions, including achievement of better balance in conventional arms. Ratification of these Treaties, with improved verification, would be a significant confidence-building step toward this goal. The Department of Energy supports these efforts and encourages the Senate to assure that no further testing restraints are mandated before appropriate arms reductions are in place.

SAFEGUARDS

The Joint Chiefs of Staff have recommended that appropriate safeguards be adopted, similar to those that accompanied the Limited Test Ban Treaty of 1963, to reduce the military risk associated with these Treaties. These safeguards would include:

Continued vigorous underground testing consistent with treaty limitations;

Maintenance of modern nuclear laboratory facilities along with a capable scientific staff;

Maintenance of the basic capability to resume nuclear tests in the prohibited environments and yield ranges, should they become vital to U.S. national security;

A vigorous verification program and continued emphasis on intelligence activities; and

A periodic review to determine if renewal of the treaties is in the U.S. national interest.

The Department of Energy endorses these safeguards and encourages the Senate to give them serious consideration as part of the ratification process.

RESERVATION

The President's letter to the Senate Armed Services Committee of October 10, 1986, requests that the Senate condition its advice and consent to the ratification of these Treaties on the conclusion of additional protocols or other agreements with the Soviet Union that would make them effectively verifiable by providing for direct, accurate, yield measurements taken at the site of all appropriate nuclear detonations.

The on-site CORRTEX hydrodynamic yield measurement technique with its supporting arrangements can provide the capability necessary to improve the verification of these treaties and to alleviate the mutual suspicions and challenges that have occurred over the past decade due largely to the inadequacy of national technical verification methods. I encourage the Senate to adopt this reservation.

CONCLUSION

In conclusion, I recommend the ratification of these Treaties with the reservation requiring effective verification recommended by the President.

Thank you.

Senator EXON. Thank you very much, Admiral Foley.

We will proceed under the 6 minute rule. I would remind members of the committee that the following panel will be in a position probably better than any other to respond to some of the technical details. So, since we have a very tough schedule today, I would suggest that, as much as possible, with this panel we try to stick to broad policy issues and save our technical questions for the next panel.

CONTINUING VERIFICATION MEASURES

I will start out by asking each of you how long would you recommend our continuing observance of the limits if the Soviet Union does not agree to extra verification measures as the administration is pressing for?

Dr. BARKER. I will start, Senator Exon. I am sure my other panel members will contribute to that.

As I indicated earlier, I head the U.S. team which is trying to convince the Soviets to negotiate verification improvements to these treaties.

I think if, as a government, we make clear our commitment, both in the legislative and executive branches, to the requirement for improved verification, we will ultimately achieve our goal.

I look to the laboratory directors, who are responsible for the development of nuclear weapons for the Department of Defense, as the real authorities on the issue of when the 150 kiloton limit constitutes an unacceptable burden for the security of this country.

To date, they tell us that all identified military requirements can be met within the 150 kiloton limit, albeit with this reduced reliability.

The Soviet Union, however, continues to take steps which threaten the survivability of some of our deterrent systems. They continue to take steps which make our systems less effective deterrents. It is not out of the question that defense requirements could change in a way which might cause the laboratory directors to one day tell us what they can no longer meet defense requirements while adhering to the 150 kiloton limit.

I think those are the factors that would have to be considered. I cannot give you a specific date.

Senator EXON. I appreciate that.

Let me say that I have tried to admonish those of us here to be short with our questions, as much as possible. If you could be as short with your replies as possible, it would be appreciated.

I asked a very simple question.

General, what do you think we should do? Do you think we should break out of the treaty right now unless the Soviet Union goes along, or should there be a timeframe?

General VESSER. We believe the safeguard which we have submitted that says we should have an independent governmental review at periodic intervals to determine whether or not continued compliance with the limitations are in the U.S. national security interest should provide the President and Congress the data needed to make that determination.

I would say that it is my judgment that those reviews should be conducted both periodically and also any time that the intelligence-gathering safeguards we have talked about indicate there is an indication that the Soviets are significantly and continuously violating the 150 kiloton limit, Senator.

Senator EXON. Thank you.

Secretary Foley.

Admiral FOLEY. I will take a little different tack to that one, sir. I will give you a specific answer, and that is a few years. It depends on the target base. You tell me what the target base is that we are going to have to go against, and I will tell you whether or not the laboratories or the Department of Energy can design a warhead that we think will take care of that target.

As far as we can tell, for the next few years, we believe we can meet the requirements. Beyond that, it is an uncertainty.

When the military requirements are unable to be met by the existing technology or the tests that we have already done out to the last 10 years or so, then it is time to consider, as a government, changing it.

Senator EXON. Well, gentlemen, what would be wrong with the administration taking a position that we are going to maintain our limitations and encourage the Soviets to do so for at least 1 year, with that intervening 1 year period being set aside for negotiations between the two countries to modify the treaty so as to take advantage of some of the new verification developments that have come along in the last 10 years?

What would be wrong with a proposition like that?

Dr. BARKER. As a starting point, Senator, probably it is an acceptable position to take. However, I assume, were the Senate to take that position, if at the end of 1 year it appeared that 10 more

days would be necessary to negotiate an agreement, I suspect the Senate would agree to such an extension.

If that is the case, does the explicit declaration of 1 year really have that great a meaning?

Senator EXON. Thank you.

Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

I have a question that I would like for each of the panel members to answer.

RATIFICATION WITH EFFECTIVE VERIFICATION

Each of you has concluded that ratification of these treaties with effective verification is in our national security interest.

Could each of you summarize the major factors that brought you individually to that conclusion.

Dr. Barker, we'll start with you.

Dr. BARKER. Thank you, Senator.

I believe that the Threshold Test Ban Treaty and Peaceful Nuclear Explosion Treaty, if effectively verified, impose the same limit on both the United States and the Soviet Union. To date, we, the United States, have not identified any military requirement which requires testing above 150 kilotons.

We can accept such a limitation as being consistent with our national security objectives if we can be sure that the Soviet Union is bound to the same constraint.

That is why I believe, with effective verification, ratification of these treaties is in the national security interest of the United States.

Senator THURMOND. General Vesser.

General VESSER. Senator, I have reached this conclusion because I believe that within provisions of the treaty, with verification and the safeguards I mentioned, we can insure that our nuclear weapons are safe, reliable, and survivable, and that we will have the weapons we need to carry out our strategy of deterrence.

Senator THURMOND. Admiral Foley.

Admiral FOLEY. Thank you sir. We can meet the requirements with a limitation of 150 kilotons. We can meet the Defense Department requirements, as presented to the Department of Energy, for us to design warheads.

As long as I know that at the same time the Soviets are living up to the 150 kilotons, then they are not gaining any advantage on us. Therefore, if we stick to that, I can live with that.

Senator THURMOND. Dr. Barker, the Soviets have been reluctant in the past to negotiate verification provisions along the lines suggested by the President.

In your judgment, as a member of the negotiating team, is there a difference between the proposal of Senator Pell and the approach proposed by Senator Kassebaum with respect to increasing Soviet incentives to negotiate verification procedures?

Dr. BARKER. Thank you for the question, Senator Thurmond.

In my opinion, the Soviets are strongly influenced by what goes on within the Senate of the United States with respect to the position they take at the negotiating table. The most important thing

to come out of the process that the President has initiated would be Senate endorsement of the need for improved verification. The message will be even more strongly delivered if the Senate indicates that it wants to judge the effectiveness of those provisions once they have been negotiated.

So, between the two choices you have given me, I believe that the Evans-Kassebaum formulation is one which does provide the Senate the opportunity—it puts the Soviets on record that the Senate of the United States will also judge whether verification provisions have been effective.

MILITARY CONSIDERATIONS FACING JCS REGARDING TREATIES

Senator THURMOND. General Vesser, can you comment on the military consideration that faced the JCS at the time these treaties were negotiated and the military considerations you face today?

Have there been changes in the military requirements and in the military significance of yields in the neighborhood of the 150 kiloton threshold?

General VESSER. Clearly, Senator, over the past decade, the threat we face, that we must deter, has changed.

The Soviets have continued steady, substantial improvement of their military forces across the board.

In the nuclear arena, they have pressed ahead with the development and deployment of new generations of more capable land, sea, and air forces for nuclear attack.

Modernization of their fourth generation of ballistic missiles has led to significant increases in numbers of warheads and system accuracy.

Today, the most accurate version of the SS–18 missiles alone are capable of holding at risk most time-urgent and hardened targets in the United States.

Additionally, the Soviets have mounted a considerable effort to increase survivability and endurability of their ICBM forces through mobile land deployments, while they have pursued a full range of passive, strategic defensive programs to protect leaders, preserve vital functions of government, and limit damage from retaliation.

Our ability to continue to hold Soviet high value targets at risk may need to include such technologies as earth penetrators, probably at yields not currently available.

Senator THURMOND. Thank you.

I believe my time is up, Mr. Chairman. Thank you.

Senator EXON. Thank you very much, Senator Thurmond.

Senator Kennedy.

Senator KENNEDY. Thank you, Mr. Chairman.

SOVIET COMPLIANCE

I think the panel indicated that if they were convinced that the Soviets were prepared to comply with the 150 kiloton limitation, that our security interests would be consistent with that. I think I am correct in that.

What about 100 kilotons?

Admiral FOLEY. No, sir.

Senator KENNEDY. So, it is somewhere between 100 and 150, is that it?

Admiral FOLEY. No, Sir.

One hundred fifty is as low as I would go. We have done rather careful analysis with the laboratories and the Department of Energy and our consensus across the board—and you can query the lab directors, as I am sure you will, sir—is that 150 is the bottom limit that we believe we can meet the requirements of the Department of Defense with as we can foresee them for the next few years.

OPPOSED TO HALT IN TESTING

Senator KENNEDY. Then I gather that even if we were able to get adequate verification, you would still not support any halting in the testing. Is that correct?

Admiral FOLEY. That's correct, sir.

Senator KENNEDY. Is that correct for the whole panel?

Dr. BAKER. Did you say halting the testing?

Senator KENNEDY. Yes.

If you had all the verification that you wanted, that the President required of you, you would still be opposed to any comprehensive testing ban?

Dr. BARKER. Absolutely.

General VESSER. That is correct.

Admiral FOLEY. [Nods affirmatively.]

Senator KENNEDY. So, the question of verification isn't the issue, really, on limiting nuclear testing?

Dr. BARKER. No. I have to disagree, Senator.

Verification is the whole issue with respect to ratification of the Threshold Test Ban Treaty and the Peaceful Nuclear Explosion Treaty. But for a comprehensive test ban Treaty, there are many criteria other than improved verification which are necessary before it would be in this country's best interest.

General VESSER. I would have to add to that and say that we would have serious military concerns if we did not have verification for the TTBT because the possibility that the Soviets could be testing weapons as high as 300 kilotons without our knowing it could give them some advantages in weapons design.

Senator KENNEDY. But, even if you had all the verification that you wanted and that is desired by the President, this particular panel still would not favor a comprehensive test ban for the Soviet Union and the United States—even-steven, absolute verification in terms of testing. You still are opposed to it? You still believe that it is in our security interest and the security interest of our allies for the United States to continue to go ahead with testing, is that correct?

Dr. BARKER. As long as we must depend upon a nuclear deterrent, we will require nuclear testing to make sure that that deterrent is reliable, safe, and secure.

Senator KENNEDY. Well, when you don't have to depend on it, you are not going to need it, are you?

No.

So we just ought to spell this out, so that no one is under any illusion with regard to what the administration has been talking

about. This administration does not support a comprehensive test ban even though this country is committed, under previous treaty, to working for such a ban. You are not for such a ban as long as there is any need for nuclear weapons. That is what I gather from this panel.

Dr. BARKER. Senator, I don't believe that there has been a change.

I believe this country has always recognized the relationship between nuclear testing and the reliability of nuclear weapons.

Senator KENNEDY. Well, we haven't got the time to debate that, but I would take issue with you on that.

General VESSER. May I take issue with you, Senator, on one point. You indicated even-steven. We believe that there are existing asymmetries in capabilities; that is, the Soviets' larger missile throw-weight, weapon design philosophy and target sets, which would favor the Soviet Union—that is, that a Comprehensive Test Ban Treaty would not affect the United States and the U.S.S.R. equally.

Senator KENNEDY. Well, we would have to wrestle with the question whether you would switch strategic systems, our systems for the Soviet Union's. You are not suggesting that, General, are you?

General VESSER. No. I am not suggesting that, Senator.

Senator KENNEDY. OK.

So there must be something valuable about our own systems.

THIRD WORLD COUNTRIES AND NUCLEAR WEAPONS

What kind of security threats to the United States does the possibility of Pakistan obtaining nuclear weapons—or any other Third World country—pose to our security interests? None of you has mentioned the danger of Third World countries moving on into developing nuclear weapons. I think there is pretty good evidence that a number of them are very close to doing it.

How would you evaluate that potential danger?

Dr. BARKER. Senator, we all should be very concerned about nuclear proliferation. This country spent and continues to spend a great deal of effort in dealing with other nations in the world, trying to help them appreciate that their own security, and their own regional security, is probably not enhanced by their development of nuclear weapons.

However, this is an issue which, in my mind, is totally distinct and separate from the requirement for the United States to continue testing in order to maintain the reliability of its deterrent.

Senator KENNEDY. Could you tell us now what your estimate is in terms of other Third World countries' capability of going to testing?

Dr. BARKER. I certainly could not give you a guestimate.

If you remember, I think some 20 years——

Senator KENNEDY. I'm not looking for a guestimate. I am looking for a hard kind of evaluation. This is clearly a matter that I would think would be of serious concern to the United States and our security interests.

Dr. BARKER. Estimates have been consistently wrong, Senator, in terms of the rate at which proliferation would occur.

So far, we have been very successful—and this is an area where we and the Soviets have worked together—in discouraging the proliferation of nuclear weapons within the world. As long as we and the Soviets continue to be effective in this regard, I think we may see no proliferation.

Senator KENNEDY. My time is up.

Senator EXON. Thank you, Senator.

Senator Quayle.

Senator QUAYLE. Thank you, Mr. Chairman.

First of all, congratulations for having these hearings. I think it is very important that when treaties come before the Senate, we get a military viewpoint from the armed services perspective. So I want to go on record and thank you for having these hearings.

TELESEISMIC APPROACH TO VERIFICATION

Dr. Barker, could you tell me in your professional opinion, is the teleseismic approach to verification an adequate safeguard against violation of the TTBT?

Dr. BARKER. Absolutely not, Senator.

Senator QUAYLE. Absolutely not.

What would be required, in your opinion, for adequate verification?

Dr. BARKER. We need to be able to make direct hydrodynamic yield measurements of every Soviet test that might otherwise be perceived to be above 150 kilotons by teleseismic means. We have developed the technology that will enable us to do that. This requires prior notification of any test whose yield would be above 75 kilotons and emplacing a CORRTEX instrument in close proximity to that explosion which would determine the accuracy of the yield to within 30 percent.

Under those conditions, we could, indeed, be sure of compliance with the 150 kiloton threshold of the Threshold Test Ban Treaty.

COMPREHENSIVE TEST BAN

Senator QUAYLE. Let me focus a little bit on the line of questioning of Senator Kennedy, on the Comprehensive Test Ban, because I think that is where a lot of people in the Congress would like to go. The ratification or nonratification of the TTBT is just a step toward a Comprehensive Test Ban Treaty.

General Vesser started to get a little bit into the asymmetry which would exist if, in fact, you have a total Comprehensive Test Ban Treaty.

I guess I would like to get the opinion of our panel on what kind of advantages or disadvantages a Comprehensive Test Ban Treaty would have.

One of the concerns that I have about it is the nuclear defenses that the Soviet Union currently has—the Galosh system, the SA-X-12, possibly the 10. These are nuclear defenses. The United States doesn't have any. To be able to assure penetration of our weapons systems or how we are going to assure they can survive the nuclear effects requires nuclear testing.

I guess we would be left with a choice if we had a total Test Ban Treaty whether to go ahead and deploy nuclear defenses or to

somehow get the Soviet Union to take out theirs; otherwise the Soviets could make the penetration of our weapons uncertain and yet get a free ride in targeting the U.S.

I wonder if you might share with us some of the advantages and disadvantages from a military point of view that we would have in this world of a Comprehensive Test Ban Treaty.

Who will begin?

Dr. BARKER. I will start and will try to be brief.

Senator, I cannot find any military advantage to a comprehensive test ban at this time.

Senator QUAYLE. Military advantage to whom?

Dr. BARKER. To the United States.

Senator QUAYLE. How about to the Soviet Union?

Dr. BARKER. Apparently, the Soviet Union feels there is something to be gained in view of the fact that they tried to draw us into a cessation of testing over the last 18 months.

Senator QUAYLE. What would the military advantage be to the Soviet Union.

Admiral FOLEY. Let me address that for a moment, Bob.

Senator QUAYLE. I guess there seems to be, in response to Senator Kennedy's questioning, in fact, an advantage, which I tend to agree, that would go to the Soviet Union in an environment of a comprehensive test ban Treaty.

Admiral FOLEY. A comprehensive test ban right now, sir, at this time.

It would seem to me that we are dealing right now, in our design of nuclear weapons, at the higher yields with technology that is at least 10 years old. But we had sufficient confidence in it that we can design weapons now for the higher yields based on developments done at that time.

But, as your confidence in the efficacy of the stockpile tends to diminish, as you go along, then you say well, maybe I'll use two instead of one, just to make sure that they are all going to work.

There is a destabilizing effect, then.

The Soviets, as far as we can tell with some limited knowledge, probably tend to more robust types of weapons systems, with more nuclear material in them, and those are things that you can put on the shelf and leave for a longer period of time, even though we don't know a great deal about it.

So, as time would go on, you would have more confidence in these sorts of systems; whereas, in ours, they are designed for a specific purpose, safety dominates, you minimize the amount of nuclear materials and you go for accuracy. They are much more sophisticated type weapons, so far as we can tell.

Therefore, as time goes on, you have more reliability perhaps in the Soviet type of engineering than you would in ours, and a greater military confidence that your weapons are going to last longer, be more reliable, and be able to be utilized.

That, I think, right off the top of the head, from a design viewpoint, gives you a clear military superiority on their side.

Senator QUAYLE. On the Soviet side?

Admiral FOLEY. Yes, sir.

Senator QUAYLE. General.

General VESSER. Senator Kennedy touched upon an important point when he implied that I would not want to switch, and I would not want to switch nuclear weapons with the Soviets, because we rely on high technology, highly accurate nuclear weapons systems.

The efforts that we have made insure that we have the safest weapons possible, and, further, weapons which we believe will produce minimum collateral damage should we ever have to use them.

Looking at the Soviet advantages in this kind of environment, that is, under a comprehensive test ban, we believe that they have a well tested but more conservatively designed nuclear stockpile, that is, a smaller number of designs, which would be more durable and more reliable under a comprehensive test ban regime.

In addition, we know, just as Admiral Foley has suggested, that, as our confidence goes down in the reliability of weapons, as one goes on into such an environment, the Soviets have a larger missile throw-weight, which will enable them to deploy heavier, more conservative warheads and greater numbers of warheads to compensate for decreased confidence under such a regime.

SOVIET NUCLEAR DEFENSES

Senator QUAYLE. What about the Soviet nuclear defenses, and then my time will be up?

What about the Soviet nuclear defense capability? Is that not an issue on testing?

Dr. BARKER. One of the most important reasons we test, Senator, is to evaluate the survivability of our military hardware in a nuclear environment. It is the category of test called "effects testing."

In the absence of testing, we would lose our confidence that our systems could survive the kind of threat which Soviet nuclear defenses would pose to our offensive forces.

Senator QUAYLE. And we do not have nuclear defenses?

Dr. BARKER. We do not have nuclear defenses.

Senator QUAYLE. So that is an asymmetry and that would be an advantage to them, would it not?

Senator EXON. Senator Quayle, your time is up. I hate to interrupt you, though.

Senator QUAYLE. Are we going to have a second round, Mr. Chairman?

Senator EXON. We are going to try, but we do have all kinds of problems and time constraints that we are worried about.

Senator Nunn.

Chairman NUNN. Thank you, Mr. Chairman.

I want to thank you, Mr. Chairman, and Senator Thurmond, for having these hearings. I don't know how far we are going to go with these two treaties. It may be that we won't go anywhere with them, the way things look now. But the hearings will be useful in the deliberations in the future.

Dr. Barker, as I understand your answers, basically you are saying that your first choice is not the President's position.

Dr. BARKER. The distinction I tried to make, Senator Nunn, between the so-called Pell form of the resolution and the Evans-

Kassebaum form of the resolution was that one called for Senate concurrence that verification was effective.

The President's resolution, as submitted by the President, did call for the Senate's concurrence, the Senate advice and consent to the verification provisions.

Chairman NUNN. I thought you had endorsed the Kassebaum resolution, which is not ratification of the treaties but, rather, a resolution just urging verification. That was my understanding of your answer to Senator Thurmond's question.

Dr. BARKER. No.

I understood Senator Thurmond's question to offer me a choice between the language associated with the Pell formulation of the resolution or the Evans-Kassebaum formulation. It is my understanding that the Pell formulation drops from the language that the President submitted the requirement for a Senate advice and consent to the verification provisions.

Chairman NUNN. I think you have a misunderstanding, or maybe I do, or it may be some mixture for both of us. But the Kassebaum-Evans resolution does not ratify anything subject to any second vote. It is simply a resolution urging the Soviets to adopt verification procedures.

Is that what you understood when you endorsed it?

Dr. BARKER. I understood the Evans-Kassebaum resolution to state that the Senate of the United States is vitally interested in the effective verification of those treaties and would not give its advice and consent to them in this totality until they were also convinced that the treaties were effectively verifiable.

Chairman NUNN. Well, that is not ratification at all. It is a resolution. There is a fundamental difference.

That is not what the President sent up. That is not the administration position.

So, my question to you is this. You have your personal position and we want you to have that. We want you to answer.

But, basically, you are saying that your first priority is not what the President sent up if you are endorsing the Kassebaum-Evans resolution.

Dr. BARKER. Please, Senator. I was not offered the choice.

If I were offered three choices—the resolution the President submitted, the Pell formulation, or Evans-Kassebaum—my choice is clear. The formulation that the President sent forward is the administration's, and my, preferred approach.

I personally believe that Senate——

Chairman NUNN. Which do you prefer now in the other two choices? Do you prefer the Kassebaum-Evans resolution or do you prefer the Pell ratification, subject to verification, but not subject to a second vote?

Which of those two do you prefer because that is going to be the choice?

Dr. BARKER. I may need legal advice on this, Senator. What is important to me and what I believe is important to the——

Chairman NUNN. Now this was not meant to be a Fifth Amendment question.

Dr. BARKER. The net effect I want is to ensure the Soviets know that the Senate of the United States fully supports the require-

ment for improved verification and that the Senate of the United States feels strongly enough about it that it wants to see those verification provisions before the treaties are ratified.

Chairman NUNN. All right. If you would like to supplement your answer for the record, that would be fine.

[Insert not desired by Dr. Barker.]

Chairman NUNN. I think, Mr. Chairman, where we are on this is the following.

Last year, we had a proposal in a House bill that cut off all funds for any U.S. testing above one kiloton unless the Soviets resumed testing or they refused to accept and implement reciprocal in-country monitoring arrangements.

I would like a letter to go into the record, Mr. Chairman, at this point explaining what the agreement was, why it came about, and I think that background is essential.

[The information follows:]

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
Washington, DC, February 6, 1987.

Hon. ROBERT C. BYRD,
Majority Leader, U.S. Senate, Washington, DC.

DEAR ROBERT: In accordance with our conversation, I have refreshed my recollection and reviewed my records regarding the Congressional negotiation with the White House at the end of the 99th Congress regarding the 1974 Threshold Test Ban Treaty and the 1976 Peaceful Nuclear Explosions Treaty (TTBT/PNET).

As you know, President Reagan pledged in an October 10, 1986 letter to Senator Goldwater that at the Reykjavik summit he would inform General Secretary Gorbachev that if the Soviet Union would agree to essential supplementary verification procedures for the TTBT/PNET, he would request the Senate as a first order of business in the 100th Congress to provide its advice and consent to the treaties as strengthened by the improved verification measures.

If, however, the Soviets refused to agree to such supplementary measures prior to the convening of the 100th Congress, the President pledged that he would still ask the Senate to proceed with ratification of the treaties "with an appropriate reservation to the treaties that would ensure they would not take effect until they are effectively verifiable." The President promised that he would work with the Senate in drafting this reservation.

The second, and equally significant, commitment in the October 10 letter was the President's pledge that he would inform General Secretary Gorbachev in Reykjavik that once our verification concerns had been satisfied and the treaties had been ratified, he would immediately propose new U.S./Soviet negotiations on further limitations on nuclear testing.

The text of this letter was carefully negotiated between Members of the Armed Services Committees of the House and Senate, including Senator Warner, Congressman Aspin, Congressman Foley, and myself, and the staff of the National Security Council. The letter went through several drafts and the final text was personally approved by the President.

The negotiations that culminated in the President's October 10 letter began between Admiral Poindexter and myself on Air Force One returning from the dedication of the Carter Presidential Library. I also discussed this personally with the President in Admiral Poindexter's presence on Air Force One, although my conference with the President was neither lengthy nor extensive. The point, though, is that the President was personally involved from the very beginning of the negotiation and should therefore have been fully aware of both the letter and the spirit of his October 10 pledges.

During the flight back from Georgia, I outlined in detail to Admiral Poindexter my rationale for making the proposal that President Reagan request Senate ratification of these two treaties subject to an appropriate reservation on verification. I gave Admiral Poindexter the following reasons why I believed this to be in the best interests of the United States:

1. The Soviet Union, since 1983, has maintained that even if it agreed to additional verification provisions proposed by the United States, there would still be no guarantee that the Senate would ratify these treaties. I stressed to Admiral Poin-

dexter that by having the treaties ratified in advance by the Senate, subject only to a suitable verification regime, this argument would be taken away from the Soviets and they would clearly be put on the defensive—resulting in considerable additional leverage in working out the required verification enhancements.

2. The President's pledge to begin new negotiations on further limitations on nuclear testing immediately upon the satisfaction of our verification concerns and the entering into force of the TTBT/PNET would provide the Soviets with additional incentives for agreeing to the additional verification provisions.

3. Even if the Soviet Union refused to agree to the additional verification measures, the situation would still be considerably improved from one in which the Soviet Union was continually reminding the world that it was willing to cease all nuclear testing and sign a Comprehensive Test Ban (CTB) treaty while the Administration was refusing even to ratify two far less restrictive nuclear testing treaties, signed, respectively, by Presidents Ford and Nixon.

4. I also stressed to Admiral Poindexter that the House of Representatives conferees on the fiscal year 1987 defense authorization bill were adamantly supporting the 1-kiloton test moratorium contained in the House bill. A Presidential commitment along the lines I was suggesting might prove acceptable to a majority of the conferees as an alternative to the House position, which the Administration vigorously opposed and viewed as detrimental to the President's position with General Secretary Gorbachev in the impending summit in Reykjavik.

5. If this initiative proved successful, it would stop the erosion of the Constitution in the area of treaty-making. With TTBT/PNET, as in the case of SALT II, the United States has for years abided by treaties on which the Senate has never formally given its advice and consent. I know that you share my view that such a de facto treaty implementation procedure was not what the Founding Fathers had in mind when they established the Senate's important prerogatives in this area.

I made these same points to the House conferees in urging them to accept this proposal in lieu of the legislated test ban which was in the House defense bill.

In my judgment, the TTBT/PNET reservation proposed by the President in his January 13, 1987 message to the Senate is inconsistent with both the letter and the spirit of the agreement we reached in October. A requirement for a second ratification vote in the Senate was never discussed with Admiral Poindexter and would have obviated all of my reasoning in the points I made with him. If the Administration had at any point during the negotiation indicated that they would advocate or support a second ratification vote requirement, I—as the author of the proposal—would have rejected the idea without even presenting it to the House conferees. If, however, I had taken such a suggestion to the House conferees, I am confident they would have not only rejected this specific proposal but also concluded that the entire approach to nuclear testing limitations that we have discussed was not being presented with even a scintilla of good faith.

For these reasons, I strongly oppose the reservation on TTBT/PNET submitted by the President on January 13. As you know, recent discussions with the White House have failed to persuade the Administration to delete the requirement for a second vote. In light of the White House's refusal to act in good faith on the commitment it made last October, I believe it would be an exercise in futility for the Senate to continue to try to uphold its part of the bargain by trying to secure approval of these treaties.

If the Administration continues to insist upon or support a second ratification vote requirement, it will in effect have scuttled a prudent and sensible approach to achieving further limitations on nuclear testing—and done so with its eyes wide open. I also believe the Administration will be buying a bucket full of trouble in both the House and the Senate as we deliberate on arms control amendments this year. I will find it very difficult to place much credibility in White House assurances since there is apparently no corporate memory as to the letter or the spirit of firm Presidential commitments.

Sincerely,
SAM NUNN, *Chairman.*

Chairman NUNN. Those who do not want to ratify the treaties are basically saying that the compromise the President agreed to last year, as a way to get the House provision which the President opposed off the bill, is not going to go through. That has happened because calling for the second ratification vote is contrary to the agreement that Admiral Poindexter and I have. We never talked about it specifically because if that had ever been brought up, it

would have rendered the whole conference agreement absolutely worthless. It makes no sense for the Senate of the United States to go through 1 week, 2 weeks or 3 weeks of voting and ratification on one provision only to come right back and do it again.

We need to give the President some discretion in working this out, and that is the reason the Pell resolution has come out.

But I, Mr. Chairman, believe that that is a moot question because the President and the White House have not lived up to the spirit of the compromise that was entered into right before Reykjavik, when Speaker O'Neill called and informed the President of the compromise. That compromise has been breached in spirit, and as a result, we are not going to have ratification of either one of these treaties under any circumstances unless and until the Russians work out some verification, which I hope they do.

The consequences of that, Mr. Chairman, are that when we have another provision like this on the floor, or in the conference this year, the administration can look elsewhere for someone to lead their charge in opposing this. I may not vote for it, but you can find your leader elsewhere.

I spent 1 month with Senator Warner last year and a lot of other members trying to work this out. The spirit of the compromise has been fundamentally breached by the administration.

Everyone should recognize that. Without Republican votes there is no hope, whatsoever, of getting a two-thirds majority. It just cannot be done.

So, Dr. Barker, your testimony here—and we respect your personal view—is out of sync with the compromise last year, as is the administration position. If Admiral Poindexter were available, I hope he would verify that.

In the course of 1 month's negotiation with the National Security Council, a private conversation with the President of the United States on Air Force One, and a lengthy conversation with Admiral Poindexter also on Air Force One, no one ever brought up that there was going to be a second ratification.

I just want to make that clear and my letter ought to go into the record, Mr. Chairman.

I think these hearings will be useful. But we will have another effort on the floor this year, in the House and Senate, and I want the administration to ask for help on it, because I would welcome then reiterating the fact that if you can't live up to the spirit of an agreement you enter into in compromise, then you do not have much standing in the next go-around. And that is where you are now.

Senator EXON. May I ask a question. What do you mean "living up to the spirit"?

I remember that situation all very well. It was during a knockdown/drag-out session in conference with the House. It was right before Reykjavik. Senator Nunn and others did a great job, I thought, in coming to that agreement.

You say, Senator Nunn, that they violated the spirit of that agreement. Didn't they violate the agreement?

What does "spirit" mean?

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Chairman NUNN. The reason I say "spirit" is because there was never a mention of a second ratification vote. I cannot say that that was discussed and rejected.

Had it been brought up—and Admiral Poindexter knows this—based on all the background and so forth, it would have been laughed out of conference. And I, as the one who proposed this, would never even have dreamed of bringing it up to the House Conferees in exchange for dropping the one kiloton proposal, which I opposed.

So, when I say the "spirit," it would be misleading to say we discussed it and then rejected it. It was never discussed because it would have been so ludicrous to have discussed it under those conditions that it would not have gone anywhere. So I say it is a violation of the spirit, not the letter, of the agreement.

Dr. BARKER. May I respond?

Senator QUAYLE. Would the Senator yield for a question?

Chairman NUNN. Oh, my time is over. I will leave that up to the Chairman.

Senator EXON. Go ahead.

Senator QUAYLE. You know, obviously it takes two to have an understanding, and I think it is unfortunate that you feel the spirit of it has been violated. I certainly understand your situation.

But, in going through the letter, I guess the concern that some of us had was the effective verification, and verifiability, that the reservation was stated in the President's letter.

Now that must have meant some different things to different people.

Chairman NUNN. No. Very clearly, we endorsed and I endorse right now——

Senator QUAYLE. I thought we were going to work out, I thought there was an understanding to work out some verification procedure.

Chairman NUNN. Absolutely. Sure.

Senator QUAYLE. That was the whole issue.

Chairman NUNN. Absolutely. We agreed that the President would be left with a discretion so that we could send a treaty that had been ratified to the Russians with a verification reservation saying that we have enough confidence in President Reagan to work out a verification that is acceptable to him, and if he does that, the treaties are then in effect.

The Soviets have been saying for the last 14 years, or 12 years, that we have had two presidents, both Republican, who have had two treaties signed in good faith, and they have never been ratified by the Senate. They have been using that excuse. They are saying why should we work out another verification regime. The Senate probably won't approve it then.

So, the effort was to pitch the ball to the Soviet court, making it clear to them that the Senate of the United States would stand behind the President if he came back with verification.

Those who insist on a second ratification—and I particularly find it almost paradoxical and somewhat amusing that the administration itself wants this second ratification vote—they are basically saying that we do not have confidence in President Reagan to work

out a verification regime that is safe. We have to come back and check out that one again.

So, I think it is a self-confessed spirit of not having confidence in the President of the United States to work that out.

Senator EXON. Senator Levin.

Dr. BARKER. Excuse me, Senator Exon. I think it is important that the record indicate that none of the three of us here, representing the administration today, had any personal knowledge of the discussions to which Senator Nunn made reference, and so we are not in a position to contribute to the discussion.

Chairman NUNN. I would agree to that.

My sense of ire is not with the witnesses and I want them to understand that.

I think it is a sad state, though, when you have the foreign policy of a country and the relationship with Congress handled in this manner, where people at the top level, including the President, who were in on the discussion, do not pass on the spirit of what the compromise was. It is going to make the next conference very hard.

We are going to have another bill. We are going to have another amendment. We are going to have another conference.

This is not over. The treaties may be dead for a while, but this is not over.

So, the fact that you don't know indicates how bad the decision-making is in this administration in terms of passing the information on down the line, where you should know.

Dr. BARKER. What I said, Senator Nunn, was that I was not party to those conversations.

What I do believe is that those who were responsible for formulating the position which this President sent to the Senate did so in the belief that they were proceeding in a manner consistent with those discussions.

Apparently, it is your position that it was not. I think that the administration's bottom line on this matter is that any verification provisions must have the force of treaty, and that is the critical issue.

I mentioned lawyers earlier for the sole purpose of saying that it really is a matter of treaty law, international law, what procedures must be followed, such that the verification provisions—which I think you have indicated you support, that is, effective verification for these treaties——

Chairman NUNN. Right. Correct.

Dr. BARKER. We want to make sure that, one, the Soviets understand that the Senate fully supports the need for those measures; and, two, once negotiated, they have the same force as the treaty itself.

If that can be done without a second advice and consent process, I think the administration is not arguing for a useless second advice and consent process. What we are asking for is a process which means that those verification provisions have all of the force of the treaty.

Chairman NUNN. There is about 100 years of history on that point. It would not take a brilliant international lawyer to go back and look at the number of reservations we have had over the years.

Senator QUAYLE. Mr. Chairman.

Senator EXON. Senator Quayle, I am not ignoring you.

Senator QUAYLE. Just let me take 15 seconds.

As one who was on the conference committee but was not part of the discussions with Senator Nunn and Senator Warner, I was always under the impression that there was a reservation on this verification that was, in fact, going to be worked out.

Now, what the understanding and the——

Senator EXON. Senator Quayle, let me get into the middle of that.

If that was what you thought——

Senator QUAYLE. Well, that is what the letter says.

Senator EXON. If that is what you thought, that was certainly not the arrangement that was made.

Senator QUAYLE. It was that the verification was going to be worked out.

Senator EXON. To bring that conference out and to have a unified stand when we went into Reykjavik, that was the main thrust of all of that.

I am going to recognize Senator Levin now. He has been very patiently waiting. Then we will go to Senator Wilson.

Senator Levin.

Chairman NUNN. Senator Levin, would you yield for 10 seconds?

Senator LEVIN. Sure.

Chairman NUNN. The point is not that there would be a reservation. Absolutely.

Senator QUAYLE. There was.

Chairman NUNN. There was.

But the point is why should we debate it all the way through and them come back and do it again. It is a question of whether you are going to do it twice or once.

Senator QUAYLE. That is an entirely different issue. I understand that.

The issue to me, as part of the conference, is that there always was this reservation. Now, the understanding on how you are going to work out the reservation is something that was in the inner council and I was not a part to it. But as somebody who was involved in the conference, I certainly had that impression.

Senator EXON. Now, for the third, or maybe it is the fourth time, the Chair recognizes Senator Levin.

Senator Levin.

Senatory LEVIN. I think I should thank you at least three times, too, Mr. Chairman.

Thank you, Mr. Chairman, and welcome to the gentlemen who are at our witness table.

SOVIET NUCLEAR TEST YIELDS

The New York Times in April 1986, had a front page article which reported that Reagan administration officials said that the CIA has changed its procedures for estimating the yield of large Soviet nuclear tests and that they had done so in January 1986.

I am wondering, Dr. Barker, if you could tell us if that report is correct. Did the CIA indeed change the procedures for estimating nuclear test yields?

Dr. BARKER. The question you just asked, Senator, gets to the very core of sources and methods—an area about which the intelligence community feels very sensitive. There will be a hearing this afternoon, I understand, at which intelligence experts will be present to address the issue of monitoring. I think to do the subject justice, Senator, it would be much more appropriate to have that discussion in that session this afternoon than for us to flirt with it this morning in an unclassified forum.

Senator LEVIN. I certainly have no problem with what your opinion is as to what is appropriate to ask and what is not to ask, but this is my question: the New York Times reported in April of last year that the CIA had changed the procedures for estimating nuclear test yields, and I want to know whether or not that is correct.

Dr. BARKER. I cannot answer that question in this forum.

Senator LEVIN. All right, in this forum.

Dr. BARKER. In this unclassified forum.

Senator LEVIN. It's classified as to whether or not the CIA changed its procedures? I'm not asking what the procedures are. But you are saying that it is classified as to whether they changed their procedures?

Dr. BARKER. I have been informed by the intelligence community that they also hold dearly when they change their methods of assessing.

Senator LEVIN. I am not even asking when at this point.

Let me just ask you whether they changed them.

Dr. BARKER. All I will say, Senator, is that annually, or at least annually, the intelligence community assesses its capabilities to assess all the various things they are asked to monitor. So, indeed, annually they do reassess whether the formula they are using is adequate. Whether they change it every year is an issue that I think only can be answered in a classified forum.

Senator LEVIN. Dr. Hecker, in unclassified testimony, said that there was a recent revision downward of our official yield estimate.

Admiral FOLEY. Dr. Hecker does not represent the CIA, sir.

Senator LEVIN. Did he violate classification when he so testified?

Admiral FOLEY. We would have to check with the Agency.

Senator LEVIN. Well, I wish you would, and send it to the FBI, too.

Is that a violation of classification, that testimony?

Dr. BARKER. I am not the expert on that matter, Senator Levin. I am very happy to refer to those who are.

Senator LEVIN. All right.

The New York Times also reported in that same article that President Reagan signed a Security Decision Directive asking for a report on how the new method would reflect on past U.S. charges of violation by the Soviet Union.

My question is, has that report now been finished?

Dr. BARKER. One moment, Senator.

Senator, annually, at the requirement of the Congress, the administration reports on Soviet noncompliance with its arms control agreements.

Senator LEVIN. That is not my question.

Dr. BARKER. Any assessment about the Soviet compliance——

Senator LEVIN. Excuse me, but I am not asking you about the annual report.

I am asking you about President Reagan's decision to ask for a report as to how the new method would reflect on past charges of violations by the Soviet Union, and I want to know whether or not that report, which the President directed, has been completed yet.

Dr. BARKER. I will get that answer for the record, Senator

I do not know.

[The information follows:]

REPORT REFERENCED IN NEW YORK TIMES ARTICLE

If the article referred to the annual report to Congress on Soviet noncompliance, that report has been completed and released to Congress and, as such, constituted the administration's assessment of noncompliance based on the most current information available. If the article referred to the research program recently called for by the President, then that research program has been initiated but no final reports have been prepared to date. The current teleseismic technique will comprise only one aspect of that research program.

Senator LEVIN. Is that classified?

Dr. BARKER. That I don't know?

Senator LEVIN. No?

Well, that may be, too. Given what you folks have done to my questions and answers in an open session last year, actually your "don't know" may end up being deleted.

But putting that all aside for a moment, is the answer to that question classified?

Dr. BARKER. It could well be.

Senator LEVIN. All right. Thank you.

Do you know whether or not there has been any revision of the conclusion that in 1985, Soviet nuclear testing activities for a number of tests constituted a likely violation of the Threshold Test Ban Treaty? Do you know if there has been any modification in that conclusion as a result of the Presidential directive to reassess or of a CIA reassessment?

Dr. BARKER. It is my understanding that the annual report, which includes the conclusion you just quoted, will shortly be sent to the Congress, and I do not know the explicit language that will be used this year.

But you will have the report very soon.

Senator LEVIN. Are you familiar with Livermore Lab Director Roger Batzel's conclusion that the Soviets appear to be observing some yield limits and that Livermore's best estimate of the yield limit, based on a probabilistic assessment is that it is consistent with TTBT compliance? Are you familiar with that?

Dr. BARKER. I am, indeed, familiar with that. I am also familiar with the fact that I think it goes on further to say, however, noncompliance cannot be excluded.

Senator LEVIN. Do you disagree with that one statement that I read to you?

Dr. BARKER. With the statement as read?

Senator LEVIN. That I just read to you.

Dr. BARKER. I view that as an incomplete statement, Senator.

Senator LEVIN. So, you don't view yourself as having any difference of opinion with Livermore on this issue?

Dr. BARKER. I believe that the totality of evidence, seismic and nonseismic, supports a conclusion of likely violation, although there is certainly a great deal of ambiguity and uncertainty associated with such a conclusion.

Senator LEVIN. My time is up.

Could you answer my question. Do you have any difference of opinion with Livermore?

Dr. BARKER. Apparently I do, yes.

Senator LEVIN. Thank you.

Senator EXON. The Chair recognizes Senator Wilson for 6 minutes.

I want to congratulate the members of the subcommittee for trying to hold their questions down and you have tried to be as brief in your responses.

Because of time constraints, we are not going to have a second round. But I will, after Senator Wilson has had his 6 minutes, recognize Senator Gore who has been here for a while. He is not a member of the subcommittee, but he is welcome. I will recognize him for 3 minutes.

Then, keeping my commitment to my friend, the Senator from Indiana, I will recognize him for 3 minutes.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman. You say Senator Gore is not a member of the subcommittee. So he must just be a glutton for punishment, then.

VERIFICATION VOTE

Dr. Barker, would it be fair to say that the specific verification language contained in the submission to Congress by the administration was contingent on a second ratification vote?

Dr. BARKER. The language submitted by the President called for a second ratification vote. It called for a second advice and consent vote on the part of the Senate, yes.

Senator WILSON. If we deleted a second ratification vote, do you believe that the verification language, submitted alone, that language alone, without the second vote—do you think that would be an adequate safeguard?

Dr. BARKER. You used the word "safeguard," Senator Wilson.

Senator WILSON. In your judgment, would it adequately address the need for verification that is at the bottom of this whole dispute?

Dr. BARKER. I think the language is not explicit in and of itself to make it clear what constitutes effective verification.

Senator WILSON. All right.

In that case, Mr. Chairman, I am going to take some of my 6 minutes to comment.

Like Senator Quayle and you, we were spending long, unpleasant hours in that conference last year. Is is true that special pressures applied because of the upcoming Reykjavik visit. But at no time was it communicated to us that there was a specific agreement with regard to the verification reservation.

It was only explicitly known that that verification concern obviously underlies—it did then and does now—ratification of these treaties.

I think it interesting when my colleague and friend, Senator Nunn, says that he has chosen carefully the word "spirit," because there was not any discussion at the time about just exactly how verification would be addressed.

He says that he didn't address it specifically then because the idea of a second vote was ludicrous. I have to respectfully disagree.

I mean, I really do not see what is at all ludicrous about using a second vote. To the contrary, it seems to me, whether he thinks it is paradoxical or funny, I am very jealous of the Senate's prerogatives, whether it be a president of my administration or of another.

I think we ought to be insistent that the prerogatives are maintained. The central question here is one of the reliability of the technology, the reliability of the procedure.

Although I was not present, I think I have a pretty good idea of what has been said this morning in the testimony. There is grave concern, and properly so.

It seems to me that we are necessarily in the position, if we are to fulfill our responsibility as Senators, that we are required to insist that we either ratify all parts of treaties, not simply give carte blanche prospectively to major, unfulfilled conditions. We either go to two votes or we wait until all parts of a treaty are before us and then vote up or down on ratification at that point.

Do I have any time left?

Senator EXON. You must have because they have not raised the flag, Senator. Go right ahead.

Senator WILSON. OK.

Since I was not present, I probably shouldn't do this. But with what time may remain for me, let me ask Dr. Barker to give me a capsule of his concerns about the capability of existing technology to discharge the concerns that we have on verification.

Dr. BARKER. The Threshold Test Ban Treaty and Peaceful Nuclear Explosions Treaty, as ratified, assume that teleseismic techniques would be sufficient to estimate Soviet yield with an accuracy such that U.S. national security could be protected.

We have had, since 1974, 13 years to gather data, and in the course of that time, we have discovered that we understood a lot less about seismology than we thought we understood in 1974.

Senator WILSON. There are some insurance companies that would agree with you, by the way.

Dr. BARKER. Fundamentally, we saw no way in which teleseismic techniques alone would ever achieve accuracies substantially less than a factor of two.

The President, for that reason, concluded in 1982 that he wanted something which was a lot better than that factor of two, and also something which could be empirically demonstrated. Teleseismic techniques are always based on theory, but the treaty provides no mechanism for calibrating, for trying to understand whether your guess, whether your theoretical estimate is right.

The President has selected CORRTEX as the only technology presented to him which was capable of achieving a 30 percent accuracy. That is the technology we have been trying to negotiate with

the Soviet Union—the adoption of this CORRTEX technique, which directly measures the yields. We are confident this technique will provide a 30 percent accuracy, rate when used as a verification tool.

If we get the support of the Senate for the required improvements in verification, I think then, we will find our Soviet colleagues at the table in Geneva much more inclined to take the issue seriously and get down to the serious business of negotiation.

I hope the Senate can find a mechanism, by whatever route, for on-the-record endorsing of the need for improved verification of this treaty as a prerequisite to ratification and Senate advice and consent.

Senator WILSON. Thank you very much.

Senator EXON. Senator Gore.

Senator GORE. Thank you, Mr. Chairman. I appreciate your courtesy and the courtesy of my colleagues who are members of this subcommittee in allowing me to participate, albeit briefly.

I look forward to the day when I have enough seniority to join this subcommittee and get a full 6 minutes. I just relish that opportunity.

Senator LEVIN. You just blew half your 3 minutes.

Senator GORE. I know, I know.

The flag is already starting to wave.

Senator EXON. Well, we'll give you 3½ minutes. That will leave you a minute and a half left.

Senator GORE. Thank you.

With your permission, Mr. Chairman, I will submit some questions for the record and will just make a brief statement in the short time that is available.

I was not part of the negotiations between Senator Nunn, Senator Warner, and Admiral Poindexter and the President. I did, however, follow those negotiations closely. I personally participated in the effort to persuade House Members to give up those provisions that were in the Defense bill at that time.

I know very well that the agreement was predicated on a solid understanding about what was being given by the administration. In return, there was an agreement to send these treaties to the Senate for ratification, subject to a reservation to be attached by the Senate, which reservation would give the administration the opportunity to go to the Soviets and try to improve the verification provisions not before a second ratification vote, but before the President declared the treaties in full force and effect by ratifying them himself. The technical ratification is an action reserved to the President.

Now, this has implications, of course, for what President Reagan's successor can do.

You see, if his efforts to improve the verification provisions come to naught, and then a new President takes office and finds easier sailing in improving the verification provisions, then that President would have the opportunity to declare these treaties in full force and effect, without coming back to the Senate for a second ratification battle.

What the so-called "hard liners" in the administration object to about the President's agreement is that if he kept his word and fol-

lowed through with the agreement, then it would not reserve the opportunity for a one-third plus one vote in the Senate, in the 101st Congress, to block these treaties from taking full force and effect.

So, it is not a misunderstanding.

In my view, it is clearly bad faith on the part of the administration. The efforts to achieve bipartisanship on issues of this kind suffer as a result, and I think we have some hint of that in the earlier statements.

I have one other point in conclusion, Mr. Chairman.

Why would there be an interest in the kind of approach which was negotiated with the President? Why not, instead, take the Kassebaum approach of entreating the administration to go back to the Soviet Union to try to improve the verification before submitting it for ratification in the first instance.

The answer to that—and here comes the flag—is very simple.

We already negotiated the text of the treaty. We signed it. The Soviets negotiated it and signed it. We agreed. And then, after we go through that diplomatic dance and conclude the treaty, one nation wants to then come back and say, "Well, wait a minute, we want to reopen the negotiations after you on your side have already put it into force and effect."

The Soviets have said, privately "Look, we understand that there are some legitimate questions about the level of confidence that might be associated with verifying different yields, but don't ask us to renegotiate a treaty that we have already signed, sealed, and delivered. Ratify it and then, by this circuitous route, we will have an opportunity to go back and try to work out better verification procedures." And the method which was suggested in those negotiations and agreed to by the President would have accomplished that objective.

Thank you, Mr. Chairman, for your courtesy.

Senator EXON. Thank you, Senator Gore. We appreciate you submitting your questions for the record, and we would appreciate a prompt response to those questions from the witnesses.

Senator Quayle, for absolutely not to exceed 3 minutes, or 3½ on the outside, you are recognized.

Senator QUAYLE. I will stick to 3 minutes, Mr. Chairman. Thank you for your indulgence.

I would have just a brief observation about this treaty that has been lingering around the Senate. It was actually signed in 1974. So it is not something that was just pulled out of the woodwork. This thing has been sitting here and we have been discussing it for a number of years because there are concerns in the spirit of bipartisanship that perhaps a previous Democratic administration had some concerns about it, as a Republican administration. So I would say that there was probably some bipartisan concern about this in the past. But that may all end. We will have to wait and see.

Senator GORE. Would the Senator yield on that point?

Senator QUAYLE. As long as it doesn't count in my 3 minutes.

You would have to ask the Chair.

Senator EXON. Thirty seconds.

Senator GORE. Just briefly, the reason the Carter administration was ambivalent toward these treaties was not its concern about verification, but, rather, a feeling that attention paid to these limit-

ed treaties would subtract from the effort to get a comprehensive test ban. I think that is an important point.

What this represents is a kind of moderate, middle of the road approach, that is not attractive to either the left or the right.

Senator QUAYLE. OK. I was under the impression that the Secretary of Defense, Harold Brown, opposed it. Maybe he did it for those reasons. I don't really recall.

TESTING AND SATELLITE SURVIVABILITY

A question I would like to ask is the importance of testing, particularly on the weapons' effect and survivability of our satellites.

I think as we get into this situation, particularly in improving command, control and communications, we are using satellites more militarily and commercially. We are in space and we are going to continue to be there.

The Soviets certainly have some nuclear defenses. You have a situation where we have to rely upon these satellites.

I just wonder if Dr. Barker and the others might want to comment on the importance of testing, particularly on the weapon's effect and the survivability aspect.

Dr. BARKER. You are exactly right, Senator Quayle. Deterrence, credible deterrence, requires credible intelligence, command, control and communications systems. In this day and age, satellites play a critical role in that entire spectrum of activities.

We must have confidence that our satellites, upon which we depend for intelligence, command, control and communication, would be adequately survivable in a nuclear weapons environment in order that those functions could still be performed. The way in which we assure ourselves that these satellites are sufficiently survivable is by exposing that satellite hardware to the effects of nuclear radiation in what we call underground nuclear effects tests.

In a comprehensive test ban situation, such tests would be impossible. We could not achieve the level of confidence we have today with respect to the nuclear survivability of our command, control, communications and intelligence systems.

Admiral FOLEY. Bob, let me add to that, if I may, sir, just one little bit.

The subject always comes up about simulation, can you by various simulation techniques totally duplicate the effects that you get in these nuclear tests? The answer is no, you cannot. You can come close to some degree, but you cannot use simulation, computer technology and so forth, to duplicate the effects on all of our hardware satellites, et cetera, that you get from a nuclear explosion.

You must test in order to verify the impact and the results on our hardware.

Senator EXON. Senator Levin, just 1 minute.

Senator LEVIN. Thank you, Mr. Chairman.

I want to just ask the other two witnesses the same question that I asked Dr. Barker.

Here it is. The New York Times in April 1986, reported that at the time the administration prepared its report to Congress charging Soviet arms control violations, President Reagan signed National Security Decision Directive 202, that asked for a report on how

the new method would reflect on past U.S. charges of violations by the Soviet Union. Dr. Barker did not know whether that report had been prepared.

My question to the other two witnesses is do you know whether that report has been completed?

Admiral FOLEY. I understand that a report—and without getting into classification, though we are flirting with it all the way through your question, sir, as you know, and Dr. Barker has asked that we perhaps have this addressed by the intelligence panel this afternoon or in closed session, and I reiterate that same recommendation, sir.

Senator LEVIN. My question is do you know whether that report has been completed?

Admiral FOLEY. Completed? To the best of my knowledge, sir, there is a report and to the best of my knowledge, it has not been completed yet, sir.

Senator LEVIN. Thank you.

General VESSER. I do not know, Senator.

Senator LEVIN. Thank you.

Thank you, Mr. Chairman.

Senator EXON. Gentlemen, thank you very much. It has been a long and very interesting morning. We appreciate you being here and we would ask you to promptly reply to the questions that did not get answered on the record.

Thank you, Dr. Barker, thank you, General Vesser, and thank you, Admiral Foley.

I will call to the witness table at this time, the next panel. It consists of Dr. Siegfried S. Hecker, Director of the Los Alamos National Laboratory; and Dr. Roger E. Batzel, Director of the Lawrence Livermore National Laboratory.

Gentlemen, welcome. We will follow the usual procedure of allowing your full written testimony to be a part of the record. We would ask at this time that you proceed with a summary of your testimony, and then, if you could, please answer our questions.

Do you have any comment at this time, Senator Thurmond?

Senator THURMOND. No.

Senator EXON. Gentlemen, if you will proceed, I will call first on Dr. Siegfried Hecker.

Dr. BATZEL. I think it would be a little better if I were to go first and Dr. Hecker second. We checked that one out with your staff.

Senator EXON. Fine. However you wish, please proceed.

STATEMENT OF ROGER E. BATZEL, DIRECTOR, LAWRENCE LIVERMORE NATIONAL LABORATORY

Dr. BATZEL. As director of one of the two laboratories which have the responsibility for nuclear weapons——

Senator EXON. Would you pause for just a moment.

May we have order, please. It is very difficult for us to hear the witnesses at this end of the table.

With our apologies, Doctor, please proceed.

Dr. BATZEL. Yes, sir.

There are two laboratories which have the responsibility for nuclear research and development in this country. They are the Los

Alamos National Laboratory and the Lawrence Livermore National Laboratory.

This technology does not exist in this country outside those two laboratories. We have the responsibility for certifying the warheads which go into our stockpile.

We take that responsibility very seriously. We are convinced that weapons testing is fundamental to maintenance of our nuclear deterrent.

The current U.S. weapons program is already being conducted under limitations—the Threshold Test Ban Treaty and the Limited Test Ban Treaty.

In spite of these limitations, we have been able to meet the commitments, our commitments, to the military for weapon systems.

Modern nuclear weapons are complex technical devices, which we integrate very carefully into military packages. U.S. practice integrates them in a way that places stress on the nuclear weapons technology.

There are four basic reasons why we test.

First to maintain the stockpile and make sure that the stockpile weapons will function when if ever needed.

Second is to modernize, continuing to improve the safety and security of these nuclear weapons systems.

Third is to conduct weapons effects tests, a major issue which was raised by one of the members earlier.

Fourth is to understand what is technically feasible in nuclear weapons technology.

We know that the Soviets are very competent in a number of areas. We find published papers where they have preceded us in important areas of technology.

We have had the experience of finding problems in the stockpile of nuclear weapons which can only be corrected with nuclear tests.

We can expect that we will continue to have those kinds of problems in the future. Where they will occur, when they will occur, we cannot predict. But they will occur. And to fix those problems will require nuclear tests.

As far as the Threshold Test Ban Treaty is concerned—and that is a limitation, as I indicated—we have been able to meet our commitments under the 150 kiloton limitation. With respect to the Soviet Union, if we just mirror image them, we feel that they probably have, in fact, been able to meet their military commitments likewise. That assumes that before the Threshold Test Ban Treaty went into effect, as we did, they conducted a number of high-yield tests which allow the use of that 10-year-old technology today, to certify and provide weapons for military systems in the several hundred kiloton regime when allowed to test at the 150 kiloton level.

The issue of significance of potential violations of the Threshold Test Ban Treaty by the Soviet Union is difficult to sort out because we don't know the details of nuclear weapons technology in the Soviet Union.

Our impression is—and the data base we have indicates—that they certainly have more throw-weight and their RVs are larger. We expect that their nuclear weapons designers are not asked to optimize their systems so as to stress the nuclear weapons technol-

ogy as hard as it does ours. That mitigates, to a certain extent, the need for Soviet testing.

In terms of verification of the treaty and monitoring of the TTBT, as indicated, that is done by teleseismic means. To follow up on the statement which was made earlier, I will read our statement of the Lawrence Livermore Laboratory's evaluation of the question of Soviet compliance.

Based on our own assessment of the relationship between yields and seismic magnitudes for the Soviet test sites and the patterns of Soviet testing, we have concluded that the Soviets appear to be observing some yield limit.

Livermore's best estimate of this yield limit, based on a probabilistic assessment is that it is consistent with TTBT compliance. However, because of the statistical uncertainty of teleseismic yield estimates and the uncertainty in extrapolating U.S. experience to Soviet test sites, we cannot rule out the possibility that a few Soviet tests may have exceeded the limit.

Based on the technical factors that I have discussed above, I believe that it is impossible to state with certainty that the Soviets have or have not violated the TTBT.

Now, we have available to us another technology, a hydrodynamic yield measurement called CORRTEX, which will allow us to narrow that uncertainty banned and I believe improve significantly the verifiability of the Threshold Test Ban Treaty.

In closing I will repeat that, for the foreseeable future, if we want safe, reliable nuclear weapons in our stockpile, we must continue to test.

Thank you.

[The prepared statement of Dr. Batzel follows:]

Prepared Testimony of Roger E. Batzel, Lawrence Livermore National Laboratory

1. Introduction

As long as our national security depends on the deterrence of war with nuclear forces, I believe that continued testing is necessary to maintain this deterrence capability and that restrictive nuclear test limitations are not in our national interest. Our deterrent depends on nuclear testing and the Soviets know this.

As the Director of a Laboratory largely devoted to nuclear weapons research, I have the responsibility to certify that the weapons that have been designed at my Laboratory will function when and if they are ever needed. I have the responsibility to spell out the technical consequences of nuclear test limitations on the viability of our nuclear deterrent and on my ability to perform the necessary certification. You have the difficult responsiblity of judging my arguments, weighing these technical risks against any real and political value of nuclear test limitations.

There is a widespread (though incorrect) perception that nuclear testing fuels the arms competition between the superpowers. Because of this perception, more restrictive test limitations have been proposed to allay the fears that people and nations have about the threat of nuclear war. Nuclear explosives, if used in war, could destroy civilization. But the tests which made this outcome possible have long since been done. Treating their successors as similar in purpose and impact leads to an unrealistic policy. I personally believe that the continuing appeal of a nuclear test ban stems from an erroneous concept of what nuclear tests are all about.

The current U.S. nuclear weapons program is already being conducted under a number of limitations. These include the Threshold Test Ban Treaty (TTBT),

which limits underground explosions to 150 kt, and the Limited Test Ban Treaty (LTBT), which bans explosions in the atmosphere. In spite of these limitations, we have been successful in carrying out the major parts of our mission. Additional limitations will place our ability to perform that mission in jeopardy. My testimony will discuss the impact of test limitations and associated verification issues.

Modern nuclear weapons are complex technical devices which have been optimized and tightly integrated into an overall weapon system. Nuclear weapons operate at conditions which are virtually unique: the material speeds are millions of miles per hour, the temperatures and pressures are hotter than the center of the sun and the timescales are billionths of a second. We frequently cannot predict how a given nuclear weapon design will perform until it is tested. We cannot take all the information measured by non-nuclear means and make the extrapolations into the nuclear performance regime. We cannot always accurately assess the implications of aging which occurs in nuclear weapons, without nuclear tests.

There are four basic reasons why we have nuclear tests. First, we test to maintain the proper functioning of the stockpile of weapons we currently have. Second, we test to modernize the existing stockpile of weapons for enhanced safety, security or effectiveness or in response to the changing Soviet threat. Third, we test to measure the effects of nuclear weapons and ensure the survivability of our weapon systems and critical command, control, and communications which might be attacked by Soviet nuclear weapons. Finally, we test to avoid technological surprise by maintaining the scientific judgment necessary to understand the limits of nuclear weapon potential and by providing future options to the national decision makers. A fairly complete and unclassified summary of the role of nuclear testing is contained in Reference 1, which I would like to insert for the record.

2. Stockpile Confidence

Nuclear weapons are fabricated from chemically and radiologically active materials. Much as a piece of plastic that becomes brittle when left in the sunlight, nuclear weapons age and their characteristics change in subtle,

often unpredictable ways. Testing is required to both find problems and to assess the adequacy of fixes which are implemented. Hard experience has shown that testing is essential. Approximately, one-third of all modern weapon designs placed in the U.S. stockpile have required and received postdeployment nuclear tests for resolution of problems. In three-fourths of these cases, the problems were discovered only because of the ongoing nuclear testing. Because of our inability to understand the effects of small changes on the nuclear performance, nuclear testing has been required to maintain the proper functioning of our nation's deterrent.

All nuclear tests contribute to the data base for assessment and understanding of stockpile problems. In this respect every test is related to stockpile confidence. In addition, we perform dedicated tests with the specific purpose of verifying stockpile units.

The importance of testing should not come as a surprise to anyone familiar with complex military hardware; the life history of any piece of military hardware is filled with continual testing followed by small changes to correct deficiencies. Many of you here on Capital Hill have advocated increased reliability testing of advanced conventional weapons. A nuclear weapon is usually tested fewer than 10 times during its 20 year lifetime. Yet its predictability is fundamental to deterrence and our survival.

While many problems occurred in earlier systems (Reference 2), there are a number of relatively recent problems (Reference 3) that have been identified and resolved only by nuclear testing. In one case, deterioration of a weapon component was observed during normal stockpile surveillance, and the weapon designers judged the problem to be serious enough to require a design modification. The component was redesigned and a nuclear proof test was required to certify that the new design would perform properly.

In another case, a test of a stockpiled weapon, tested under certain aging conditions to be expected in the stockpile, gave an unexpected reduction in yield. The weapons designers suspected that various engineering design features incorporated in the weapon after the physics-design nuclear tests were successfully completed may have had an adverse effect on the operation of

the weapon. Design changes were made, and a second test was conducted to verify that the weapon would meet its military requirements.

In a third case, a final proof test at the weapon's specified low-temperature extreme was done just after deployment of the weapon had begun. The test results were a complete surprise. The device gave only a small fraction of its expected yield. The weapon had been tested extensively in nonnuclear hydrodynamic tests (including nonnuclear tests at low temperature) with no indication of trouble. Thus, on the basis of the nonnuclear testing and previous successful nuclear tests, the weapons designers had every reason to believe that the low-temperature proof test would produce the predicted yield. After extensive post-test analysis, the design was modified and another low-temperature nuclear test was performed. The test of the modified design was successful, and confidence was established that the warhead would operate properly over its entire temperature range. Thus, the appropriately modified design entered the stockpile. This experience also led us to reexamine other already stockpiled weapons and weapons under development for the same effect.

This last example illustrates yet again the inadequacy of nonnuclear testing and the need for nuclear tests. Without the low-temperature nuclear test, the weapons designers would have judged, on the basis of the nonnuclear tests, that the system would perform properly. However, in actuality, the deterrent capability of this particular weapon system would have been jeopardized under environmental conditions that could have been fully expected to occur. As a result of the experience with this particular warhead, similar low-temperature nuclear tests have been done for several other weapon systems.

It is inevitable that future stockpile problems will occur. Weapon scientists cannot address the impact of new technologies, verify that a problem has been properly fixed, or certify that a new weapon design will meets its military requirements on the basis of nonnuclear experiments alone. Nor can they model with computers all the complex physical processes necessary to predict with confidence warhead performance and warhead vulnerability.

Assessment of weapon performance rests on scientific judgment based on nuclear test experience. This judgment takes considerable time to develop. It is cultivated by the application of theory and experiment to device design, and it is continually refined on the basis of data from nuclear tests. Removing the confirmation provided by tests would result in the overextension of judgment and in the reduced credibility of the nation's deterrent. This was indeed the case (Reference 2) from 1958-1961 when the U.S. and U.S.S.R. observed a moratorium on nuclear tests. The U.S. experienced a number of surprises when certain weapons developed during the moratorium failed to perform as predicted when they were finally tested.

One of the real concerns about a test ban is that after a number of years, U.S.S.R. scientists might recognize a breakthrough and break out of the treaty. U.S. achievement of the same breakthrough would be much less likely because many U.S. weapons designers would leave the weapons program in a free society.

3. Stockpile Modernization

The directions and emphasis of the U.S. modernization program have often been poorly understood. Contrary to popular belief, the so-called "arms race" has led to a reduction in the numbers of U.S. nuclear weapons by nearly 25 percent and in the total destructive yield by a factor of four, while simultaneously maintaining adequate security for our country. This reduction would not have been possible without nuclear testing. Of more importance, however, the primary focus of U.S. modernization is on the enhanced safety, security, and survivability of our nuclear deterrent forces.

Few would argue that as long as we have nuclear weapons, they should be safe and secure. Yet a ban on nuclear testing could preclude needed changes to the stockpile in these important areas. While there have been no nuclear accidents involving the U.S. stockpile, there have been accidents which have involved the detonation of high explosive and dispersal of radioactive plutonium across the countryside. These accidents contributed to a policy which prohibits aircraft on airborne alert from carrying nuclear weapons. On

the ground, aircraft are more susceptible to surprise attack. We have now developed a new high explosive, called insensitive high explosive (IHE), which would not have detonated in these accidents. The U.S. has begun to deploy IHE in stockpiled weapons, but this replacement is only one-third complete. Because IHE performs much differently than past explosives, weapons using it must be redesigned and tested. Thus, the imposition of very restrictive test limits would preclude putting IHE into the rest of the stockpile.

The global strategic balance is a dynamic, not a static situation. Developments in non-nuclear areas such as ICBM accuracy, antisubmarine warfare, and aircraft defense can influence the need for new, survivable weapon systems. An example of the need to improve survivability of our land-based missiles is the considered deployment of a small mobile ICBM, the SICBM, or Midgetman. The cost effectiveness, weapon size, weight, degree of mobility, acceptable environments, and number of warheads for the SICBM is currently being debated. Depending on the final warhead design, the viability of the system could be compromised by a test ban.

4. Nuclear Effects Testing

A very important part of our nuclear testing program is testing the effects of nuclear weapons on a vast array of military equipment. Of particular importance are the non-nuclear components of our strategic weapon systems, warning sensors, and communications equipment which might have to work in a nuclear environment. If deterrence is to work, our forces must not present a vulnerable target to the Soviets encouraging them to take advantage of us in a crisis. As in the testing of basic weapons themselves, we are frequently surprised by the results of effects testing on equipment which has previously undergone nonnuclear testing. Changes and subsequent nuclear testing are required to certify that these important elements of our deterrent system will be able to function properly during a crisis. The head of the Defense Nuclear Agency should testify further on this subject.

5. Avoiding Technological Surprise

Under restrictive nuclear test limitations, U.S. options for responding to an evolving Soviet threat would be severely constrained. We know that the Soviets have been actively doing research on defensive systems for a number of years. There are estimates that they have been outspending us in the defensive area by almost an order of magnitude. Improvements in their air defenses have already eroded the penetrability of our bombers and they continue to make progress in this area. They have been active in anti-ballistic missile system research, including directed energy weapons. Breakthroughs in these areas could threaten the penetrability of our missile warheads in a retaliatory strike. Improvements in anti-submarine warfare capability would threaten the future survivability of our submarines. Further Soviet development and deployment in ASATs would threaten the survivability of our C^3I (command, control, communications, and intelligence) assets. Further improvements in the accuracy of their ICBMs, including the use of satellites for ultra-accurate terminal guidance, would threaten the survivability of our land-based ICBMs. Most of these likely Soviet developments are nonnuclear in nature, but our ability to react to them may require changes in our nuclear technology. We may need new delivery systems which will require new warheads and nuclear testing will be necessary for their development.

There may also be Soviet developments in the nuclear area that we are not aware of. We know they have actively done research on the x-ray laser but we do not know if they have developed an x-ray laser weapon.

A key factor in avoiding technological surprise is the maintenance of competent weapon scientists with the necessary scientific judgment to evaluate what technological developments by our adversaries threaten the viability of our nuclear deterrent. Furthermore, if the Soviets break out of a test limitation treaty, or try to evade it, we must have personnel with the necessary skills to respond.

6. Factors that Determine a Weapon Design

It has been argued that nuclear weapons can be designed to be more robust to the effects of aging and changes in deployment scenarios. However, it must be recognized, that in specifying the requirements for new nuclear warheads, the Department of Defense (DOD) prepares a set of military characteristics (MCs) that define the requirements. These requirements include, first and foremost, nuclear safety, followed by size and weight to achieve a design yield. A consistent feature of U.S. deterrent systems has been small, compact warheads tightly integrated to smaller missiles and submarines. Since nuclear warheads cost roughly 10-15% of the total system costs, this is the most cost effective approach.

The weapons in the stockpile and currently under development have been designed to be as conservative as possible with respect to the adverse effects of aging within the requirements of the MCs. Correcting a problem in the stockpile is expensive and time-consuming. The need for such actions is minimized by taking appropriate care when a weapon is designed and before it enters the stockpile. Scientists and engineers strive to make their designs durable and robust against all foreseeable stockpile conditions. Even so, situations have arisen with stockpiled weapons that have brought into question their continued endurance and reliability. Nuclear tests have been required to identify and, in a large number of cases, to resolve these problems.

If stockpile endurance were the highest priority, U.S. warhead designs would have been different. The warheads would be larger and heavier and would have contained more nuclear material. We might also have forgone many stockpile improvement features involving enhanced safety and security that tend to increase warhead sensitivity to stockpile aging. Changes in priorities could have led to very different military systems-missiles or other platforms with different throwweights, ranges, accuracies, and operational flexibility. In addition, the economic impact of a different set of priorities would have been substantial.

7. The Impacts of TTBT on American and Soviet Programs

We can meet our current military requirements and do weapons physics research that we deem to be appropriate and necessary within the 150 kt limit. The design constraints on the U.S. nuclear weapon program resulting from the 150 kt threshold have been acceptable to date. However, if the military requirements arise for development of a very high-yield RV or a high yield earth penetrator weapon to attack deeply buried or strongly hardened targets, we might not be able to develop such weapons under the 150 kt limit, and a few tests at 300 kt could be very useful.

Factors other than the impact upon the weapon development program must also be considered. We perceive that significant assymmetries could develop if the present threshold were removed. Because of ground motion in Las Vegas resulting from nuclear explosions at NTS, we would be limited to explosions of less than 800-900 kt. It would be difficult to go to other sites, say Amchitka, for reasons of cost and political acceptability. Prior to the TTBT, the Soviets tested to several megatons at their Novaya Zemlya test site, a site they continue to use. Because of the isolated nature of that site, we cannot rule out the possibility that they could resume at yields even higher than before, if a TTBT were not in force. Without a TTBT, the Soviets would thus have an advantage in the size of explosions they could conduct. The advantages of increasing test yields from 150 kt to a number of megatons could be very significant. Hence, the 150 kt yield limit has an advantage over a no-limit on yield treaty because it prevents a technically significant asymmetry in testing capability between the U.S. and the Soviets. I must emphasize, however, that if military requirements arise for new weapons with yields substantially above 150 kt, it would be difficult, if not impossible, to develop such weapons within the current TTBT limit.

8. Significance of Possible Soviet Violations of the TTBT

The nuclear design advantages of increasing test yields from 150 kt to 300 kt would not have been very significant from my viewpoint of U.S. experience. A yield of 300 kt is within the approximate factor of two

uncertainty range of current official yield estimates. (I address TTBT verification and compliance issues in Sections 9.1-9.3.) In assessing what is significant to the Soviets, we are forced to use a "mirror image" or similarity approach because we know little about their design practices. Just prior to the TTBT in 1976, we obtained enough data from high-yield U.S. tests to permit us later on to certify the yields of new strategic systems such as the MX and Trident II warheads and the B83 bomb. For purposes of assessing the current Soviet threat, we normally assume that they did similar high-yield tests prior to the TTBT. We conclude that if they did do the appropriate tests before 1976, there may be no major significance to the few tests which the Soviets might have conducted between 150 kt and 300 kt after 1976. If, on the other hand, the Soviets did not conduct the necessary tests prior to 1976, there may be some advantage and motivation for them to do so now. Cheating on the TTBT limit could provide more benefit if they were developing new weapons in the several hundreds of kiloton to megaton range.

While ratification of the TTBT would preserve the status quo at 150 kt (a potential advantage over a no-yield limit treaty in view of the asymmetries that exist between us and the Soviets in terms of the yields that can be safely achieved at our respective test sites), the preamble to the treaty calls for the discontinuance of all test explosions of nuclear weapons for all time. Such discontinuance is inconsistent with the context of the Strategic Arms Reduction Talks and arms reduction with modernization. This represents a serious concern that I have with the TTBT. The President's current proposal is the right approach.

9. Verification of Test Restrictions

Verification of compliance with nuclear test limitation treaties involves a complex mix of disciplines. Seismology currently forms the basis for the monitoring technology and hydrodynamic yield measurements have been proposed for improved monitoring. Statistical tests of the compliance hypotheses form the quantitative part of the decision making process. Ultimately, value judgments must be made about the relative importance of identifying militarily significant violations versus limiting the number of false accusations. The

goal is to deter a potential evader. Improvements are needed in the application of all disciplines, but I will focus on the monitoring aspects.

9.1 Limitations of TTBT Monitoring

Monitoring compliance with the TTBT is currently done by teleseismic means. Using its own seismic network, each nation determines the seismic magnitude of the other's explosions and then, by use of a yield-magnitude relation, estimates the yield. Successful evaluation of compliance with the 150 kt yield limit using seismic data hinges on two issues: 1) what is the correct relationship between seismic magnitude and yield for the Soviet test sites, and 2) how should we treat the variations in the seismic coupling, propagation, and recording processes that introduce random errors in the seismic magnitude measurements.

With regard to the first issue, a magnitude-yield relationship has been developed for explosions at the Nevada Test Site. However, virtually all seismic studies have shown that, because of geological differences, the relationship is different for the Soviet test sites by an amount known as the "bias". Because the effect of the bias is to shift the entire body of Soviet yield estimates to lower values, the assumed value of the bias has a major impact on one's view of the question of Soviet compliance with the yield threshold. Ultimately, it could affect one's view of the configuration of the Soviet arsenal.

With regard to the second issue, the random variations in the seismic data can make the estimated yield of any explosion appear to be either smaller or larger than its actual yield, even if the bias is known. For example, given a series of explosions with actual yields of 150 kt, half of them on the average will have estimated yields greater than 150 kt, and half smaller. Thus, the issue of compliance must be dealt with in a statistical framework. In general, the procedures which we use allow us to calculate the probability of obtaining an estimated yield as large or larger than the one which is observed

if the true yield was less than the threshold. If this probability is small, we reject the compliance hypothesis.

9.2 Soviet Compliance with the TTBT

Based on our own assessment of the relationship between yields and seismic magnitudes for the Soviet test sites and the patterns of Soviet testing, we have concluded that the Soviets appear to be observing some yield limit. Livermore's best estimate of this yield limit, based on a probabilistic assessment, is that it is consistent with TTBT compliance. However, because of the statistical uncertainty of teleseismic yield estimates and the uncertainty in extrapolating U.S. experience to Soviet test sites, we cannot rule out the possibility that a few Soviet tests may have exceeded the limit. Based on the technical factors that I have discussed above, I believe that it is impossible to state with certainty that the Soviets have or have not violated the TTBT.

The policy experts must weigh the evidence and decide whether a charge of noncompliance is warranted and whether such noncompliance is a serious breech of the treaty, given the technical issues, the uncertainties, and the assumptions. There are those who believe that any violation of a treaty is a serious matter. In regard to the TTBT, one must keep in mind that we and the Soviets did come to a common understanding that "one or two slight, unintended breaches per year would not be considered a violation of the Treaty." However, we did agree that such breaches would be a matter of concern.

9.3 Improvements in TTBT Verification

Although in the past, our assessments of Soviet compliance do not seem to indicate violations of serious significance, the accuracy of the present yield estimation methods is such that in the future we may not be able to distinguish confidently between compliance and potential violations that we would consider to be significant. For this reason we need to improve our monitoring capability.

The TTBT contains a number of provisions which have never been implemented because the treaty has never been ratified. These provisions include the exchange of information about test site geography and geology and the yields of two calibration explosions for each geophysically distinct area within the test sites. While calibration yields provided by the Soviets under the existing TTBT provisions could not be corroborated, quantitative data on the geological and geophysical properties of Soviet test sites would be useful. We already have a significant body of data on the general characteristics of Soviet test sites and it would be difficult for the Soviets to falsify such data in a useful way. The additional detail that would result from carrying out the exchange of geological and geographical data would improve our general understanding of their test sites. However, the improvement would be qualitative rather than quantitative.

Hydrodynamic yield measurements similar to those provided for in the PNET, could be useful in reducing the uncertainty in yield determination. In order to carry out these measurements on nuclear weapons tests, which typically have many diagnostic experiments of a sensitive classified nature in the emplacement hole, it is proposed to carry out these hydrodynamic yield measurements in a satellite hole near the emplacement hole. Use of a satellite hole also improves the accuracy of the yield determination. It has been estimated that the uncertainty in such a hydrodynamic yield measurement is 30% or better if some restrictions are placed on the experimental configurations of the canisters that contain the nuclear device and on the diagnostic equipment.

The presence of Soviet personnel at the Nevada Test Site would also pose operational security problems. In general, these could be handled at some increase in cost. The problems would, however, be exacerbated for nuclear directed energy weapons tests which have unique geometric arrangements. Inspection of the canisters of these tests to verify that treaty restrictions were being followed could reveal sensitive design information unless special procedures are followed.

A less intrusive program of hydrodynamic yield measurements on selected events would avoid many of the concerns about geometric restrictions and

Soviet intrusion at NTS. For example, each country could conduct a few tests at each other's test sites on which hydrodynamic yield measurements could be made. These would serve to calibrate the teleseismic signals for that testing area. This could result in an improvement in seismic yield accuracy about halfway between the accuracy of the current teleseismic yield estimates and the projected accuracy if hydrodynamic yield measurements were performed for all weapons tests above a particular trigger level.

It has been proposed that several seismic stations located at the Soviet test site near Semipalatinsk would be useful to better understand the seismic transmission characteristics of that region of the Soviet Union. It has been argued that calibration of the test site at Semipalatinsk might be derived by comparing signals (from any seismic source elsewhere in the world) detected at such stations with those detected at existing teleseismic stations. However, the calibration would not be as good as that obtainable from CORRTEX measurements and important information about the way explosion energy is coupled into the ground would not be available. The benefits of this proposal are not yet well quantified and appear to be more qualitative than quantitative at this time.

9.4 Verification Adequacy of the PNET

The Soviets have executed peaceful nuclear explosions (PNEs) at sites scattered throughout their country. The properties of the seismic wave propagation beneath these sites can vary significantly, but the PNE treaty does not provide a means to calibrate the seismic measurements for this effect. As a result, yield estimates for PNE explosions with nominal yields close to, but less than 150 kt will have larger uncertainties than the yields for explosions at the weapon test sites at Semipalatinsk and Novaya Zemlya. (Group explosions with aggregate yields greater than 150 kt allow the deployment of U.S. equipment for hydrodynamic yields to obtain an independent estimate of the yield of each device.) Therefore, under the terms of the present PNET, there is the potential for an occasional militarily significant violation. In the past, the estimated yields of PNE explosions since 1976 have been significantly less than the 150 kt limit and this has not been an issue in practice.

Other factors constrain the execution of a sustained program of significant TTBT violations under the guise that they are PNEs. 1) The yield of the device must be consistent with the purpose of the experiment. 2) The observed effects of the explosion must be consistent with the nominal yield. For example, higher yields have often been associated with cratering events, which have observable surface effects.

The data exchange provided for in the PNET protocol would provide valuable information about each Soviet PNE explosion. Such a data base would significantly improve our understanding of the geophysical properties of the Soviet Union. For example, pre-knowledge of the locations, yields, and times of their past 50 PNE explosions would have provided valuable opportunities to focus various National Technical Means (NTMs) on these events to study such aspects as detection thresholds and seismic signal propagation in the USSR.

The PNET also would establish a Joint Consultative Commission to implement the data exchange and to resolve questions regarding each country's actions with regard to the PNET. Such a forum could be a valuable channel for exchange of technical data and compliance questions for the TTBT as well.

9.5 Improvements in PNET Provisions

The primary improvements that can be suggested for the PNET consist of implementing the various existing provisions, but at lower thresholds than are now the case. With these provisions, the military benefits that might be derived from evasion attempts under the PNET will be reduced and be made comparable to that of the TTBT.

Conclusion

For the foreseeable future, safe, secure, reliable, survivable and effective nuclear weapons will be a critical element in the stability of the strategic balance and the security of this nation. The existence of these weapons reflects the reality of the tension which exists between the United States and the Soviet Union. Nuclear test bans will decrease the viability of this element of our national security. A serious question that must be asked

is how our national security will be enhanced by more restrictive test limitation. Their immediate impact seems to me to be primarily symbolic and they do not address what I believe are the most important issues: major reductions in strategic and conventional forces and a general lessening of the tension between the two countries. In fact, some believe that the diversion of political effort from the more important issues and the tensions generated by test ban verification problems will, in the long term, decrease the safety of both countries.

I believe that a nuclear test ban, or more restrictive test limitations, should only be considered in the context of an integrated and comprehensive approach to arms control. A CTB may be the correct last step in our quest for nuclear arms control and a stable peace, but it would be a disastrous first step. In my opinion, further testing limitations will better serve the goals of increased stability and decreased tension only if they are instituted after major progress has been made in reductions in strategic and conventional forces.

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Senator EXON. Thank you. Dr. Hecker.

STATEMENT OF SIEGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

Dr. HECKER. Thank you, Mr. Chairman. It is my pleasure to be able to present my views on some of the technical aspects of these treaties.

Dr. Batzel has already pointed out that we have the responsibility for the certification of nuclear weapons. Of course, let me remind you that this certification not only includes the performance of these weapons, but also the safety of these weapons.

This is a very grave responsibility that we share, and it is a responsibility that I feel we need several tools for, to be able to assure that certification.

Two of the important tools are, one, that I feel we must have a first-rate scientific and engineering staff at the laboratories. Fortunately, at this point we do have that. Second, a major tool is we need to have the ability to do nuclear tests.

I would just like to emphasize that nuclear testing really is indispensible to the life cycle of a nuclear weapon, all the way from the design through the maintenance of the stockpile stage of a nuclear weapon.

The behavior of nuclear weapons is so complex that we cannot completely model it by computer, nor can we adequately explore it through nonnuclear laboratory experiments.

We always have required, and in the foreseeable future we will continue to require, nuclear testing to be able to calibrate and test these models.

Also, importantly, nuclear testing continues to help us build the confidence of our weapons designers. It is their judgment that is really indispensible, not only in design, but also during production and to answer any reliability questions that inevitably arise during the lifetime of a nuclear weapon.

Hence, as long as we are responsible for the weapons that are already in stockpile and as long as the dynamics of world politics dictate new military requirements for nuclear weapons, then I foresee the need for nuclear testing.

Now, restrictions on testing, including those that we presently observe under the TTBT, make the job of helping to assure the credibility of this Nation's nuclear deterrent a more difficult one. All of these restrictions carry technological risks. These risks may translate into military risks, or at least military penalties.

I consider it my responsibility to bring these risks to your attention. Naturally, you and other policymakers need to judge the tradeoffs between these risks and any benefits that might accrue from such testing restrictions.

Let me turn specifically to the TTBT. I would like to elaborate on what changes have occurred since that timeframe.

Before signing the TTB Treaty in 1974, MIRVed missiles and greater missile accuracy had caused a trend toward lower yield requirements for U.S. strategic forces. So at that time, the 150 kiloton limit did not appear to be terribly restrictive. It did appear to be manageable.

However, during the 1977 hearings on these treaties, one of my predecessors, director Harold Agnew of Los Alamos, had voiced several cautions associated with these treaties. I would like to quote his cautions because I think they are very pertinent today.

I quote from his testimony:

> If you believe that there will be requirements for new, untested designs of yields considerably larger than 150 kilotons, then, if the treaty is ratified, our defense systems eventually will have to bear the penalty in payload weight, physical size, and perhaps even in additional use of fissile materials. These penalties will accrue because, under the treaty, high-yield warheads of the future will be, of necessity, the same ones as which we have developed in the past.

Indeed, since that time, there has been an aggressive Soviet program to harden and/or to bury their prime targets. These threats prompted our military to require higher yield weapons to assure a credible deterrent. In fact, if you have looked at our strategic systems over the past 10 years, the yield requirements have gone up substantially.

So, we have been faced with designing and certifying new, high-yield weapons in this 10-year-plus time period that are of yield significantly greater than 150 kilotons; but having to certify those weapons within the 150 kiloton restriction.

Now, as Agnew predicted, those sorts of restrictions would have penalties and trade-offs, and, indeed, that is what we face today. However, we feel that we can confidently say that to date, those restrictions have been manageable.

I spoke earlier of the technological risks and potential military penalties. As I mentioned, I think in that 10-year timeframe, indeed those have been manageable. But I must add that they would not have been manageable had we had restrictions that were greater than the 150 kiloton limit of the TTBT.

I am also genuinely concerned that continued Soviet hardening and burial, or perhaps other Soviet actions, will bring about military requirements, requirements needed for a credible deterrent that may prove beyond the reach of older test design technologies.

Again, I go back to the statement that Dr. Barker made earlier today, that a single test can have a substantial military implication. Indeed, currently, several of our strategic systems rely on a single test that was done back before the TTBT went into effect. In fact, it is critical to such strategic systems as the Trident II D–5 missile, with the W–88 warhead.

Let me turn briefly to the question of verification.

The importance of verification of compliance has been stated and argued many times during these hearings. From my perspective, it is important that neither side can obtain a significant military advantage through clandestine violations.

The current treaty provisions, in my opinion, do not meet that requirement.

So much controversy exists over past Soviet compliance of the 150 kiloton limit, because the interpretation of teleseismic signals of Soviet tests is inherently inconclusive. I very much agree with the position that my colleague has stated. We feel that the pattern of Soviet testing is consistent with significant violations.

What is much more important than controversy over past compliance is how can we effectively verify that compliance in the future. I think that is really the key question.

At our laboratory, we have carefully analyzed the teleseismic evidence of TTBT verification, and we conclude that the ability to conduct tests to the level of 300 to 450 kilotons, at least occasionally, cannot be denied to the Soviets under present treaty provisions.

On the other hand, the United States has scrupulously complied with those treaty provisions and will continue to comply with the 150 kiloton limit.

So, an important question now is to ask whether this asymmetry is of military significance or not.

In 1974, the answer was uncertain because the Soviets concentrated on weapon systems that were in the several megaton yield range. But now, since they have adopted MIRVed technology, their systems appear to be close to the 500 kiloton range, a range that is also of interest to the United States' strategic systems.

So, the bottom line then, as we see it, is that the Soviets can test occasionally close to a yield that is very important to development of nuclear weapons of great military significance to both countries, and that the United States cannot.

So, effective verification would place an equal burden on the Soviets. This would be a specific benefit of the ratification with improved verification—a benefit that we are currently denied under the status quo.

Today, the best way that we can assure significantly improved verification in the future is with the on-site measurements of hydrodynamic yield using the CORRTEX method that was discussed earlier.

I will not remind you of the details of the CORRTEX. I think that has been adequately discussed. Let me say that the provisions for the verification have been looked at in detail for the Peaceful Nuclear Explosions Treaty, and we have worked in the past number of years to look at the things that are specific to the Threshold Test Ban Treaty. At this particular time, we have great confidence that the uncertainty can be reduced to the 30 percent level, that is, a factor of 1.3.

Let me summarize by saying that I favor ratification of the treaties with the provision of improved verification. The United States should insist on a verification protocol that does not allow the Soviets to test at a level above a threshold at which they can achieve significant military advantage.

It is important to reiterate that all the testing restrictions carry specific technological risks and potential military penalties. The TTBT restrictions, to date, have been manageable, although I have some concerns about the restrictions in the future.

A testing constraint more restrictive than those present in the TTBT would greatly endanger our ability to adequately support the Nation's deterrent in terms of a safe, secure, reliable, effective, nuclear weapons force.

I would like to urge that any such constraints are considered only after carefully looking at this Nation's policy of nuclear deterrence.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Hecker follows:]

PREPARED STATEMENT OF DR. SIEGFRIED S. HECKER, DIRECTOR, LOS ALAMOS NATIONAL LABORATORY

I welcome the opportunity to present to this Committee certain technical aspects of the Threshold Test Ban Treaty (TTBT), the Peaceful Nuclear Explosions Treaty (PNET), and the issue of improved verification. On balance, it is my view that ratification of the treaties is in the overall national interest of the United States, provided that verification of Soviet compliance is improved in the manner proposed by the President.

In presenting my views as Director of the Los Alamos National Laboratory, I want to reiterate the role that the weapons laboratories play in the nuclear weapons program. The DOE has statutory responsibility to design and develop nuclear weapons that are determined by policy makers to be necessary to assure this nation's deterrent. The job of meeting this responsibility is assigned to the two DOE weapons laboratories, Los Alamos National Laboratory and Lawrence Livermore National Laboratory. We are also responsible for the safety, security, production oversight, surveillance and retirement of nuclear weapons. I personally have the final responsibility for certifying the weapons we design. This certification holds for both the performance and the safety of the weapons during their entire life cycle. A major additional part of my job is to guard constantly against technological surprise, primarily by potential adversaries but also by our own products, the nuclear weapons in stockpile.

Nuclear design responsibility for U.S. nuclear weapons rests strictly with the two weapons laboratories. Nuclear testing continues to be an indispensable part of the design process because of the great complexities of nuclear weapons behavior, which cannot be completely modeled by computer nor adequately explored by non-nuclear laboratory experiments. As long as requirements for nuclear deterrence are dynamic and we continue to be asked to satisfy new military requirements, or to be responsible for weapons already part of the deterrent forces, we will need nuclear tests. Restrictions,

Statement
of
Dr. Siegfried S. Hecker
Director
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before the
Senate Armed Services Committee
concerning
TTBT and PNET Ratification
February 26, 1987

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including the present ones, on our ability to test these complex devices carry technological risks. These technological risks may translate into military risks, or at least military penalties. I consider it my responsibility to bring these technological risks to your attention. You and other policy makers must judge the trade-off between these risks and any benefits resulting from such restrictions.

Before the summer months arrive, we will have had eleven years of strict compliance with the 150 kiloton (kt) limit imposed by the TTBT on our nuclear test program. I shall outline our experience during this period. An important aspect of that experience, particularly since 1977 when the last hearings on these treaties were held by this committee, has been a significant change in military requirements for new weapons with yields well above the 150 kt limit. These requirements have resulted primarily from Soviet actions in the past decade. As a result, they were not reflected in the earlier testimony on the treaties now under review.

I am sure that the Committee is aware that both the total megatonnage and the number of weapons in the U.S. nuclear arsenal have declined significantly during the past two decades, the first by a factor of four and the second by one-third. It follows that the average weapon yield today is well under half what it was in the mid-60s. This trend in part reflected a major shift to MIRV technology in our strategic forces.

In 1974-77, the Soviets were beginning to explore MIRV technology themselves. For several years it was hoped that the Soviets would exercise restraint in deployments of the new MIRVed missiles, which because of the large Soviet payload capability would have a significant counterforce potential in large numbers. By the end of the last decade, it was clear that both the size of the Soviet threat and the greatly increased hardness of Soviet silos and other important military and political assets posed a fundamentally new problem. A strategic nuclear targeting review culminated in the Carter Administration's PD-59 directive, followed shortly by the present Administration's NSDD-13 directive. Both directives, among other important changes, called for improved U.S. capability against hardened military targets. This action affected the yield requirements for both the planned MX Peacekeeper missile and the Trident D5. In the TTBT environment, this clearly created a problem for the weapons laboratories.

We were able to respond to the new requirements, and to others that arose in the same period, because of advanced development testing done before the TTBT limit became effective. A test of the greatest importance to this response, in fact, was done as early as 1973. Others were done as late as

Spring, 1976, in anticipation of possible future requirements that could not be met under the 150 kt limit. Thus, because of this inventory of tested assets, we were able to meet requirements for new high-yield weapons despite the restriction on testing. It may be more difficult to meet foreseeable future requirements under the TTBT constraints.

Let me now describe in more detail the effect that strict compliance with the 150 kt limit has had on our test program and on our ability to meet our responsibilities. First, a number of tests were precluded by the TTBT limit that almost certainly would have been done otherwise. Among these were full-yield tests of new or modified high-yield designs based on older tested technology, as well as full-yield stockpile confidence tests. In addition, tests of new design concepts that may become important in the future could not be done. We have exploited our reserve of older tested technology, and we have been unable to replenish and extend it as we did in anticipation of the threshold limit.

When we examine the nuclear tests that still were permissible over the ten year period following March 31 1976, we find that a significant fraction of them were affected by the yield limit. We also find that the tests affected were among the most important. They include more than one-fourth of the stockpile-confidence tests during this period and about one-eighth of the tests in the categories of weapon development and advanced design technology. These three categories together made up over half of the total for both laboratories, and they were the ones that most directly supported DoD requirements for new weapons and for weapons with improved safety and security. The TTBT constraint limited the value of the tests in question.

In spite of this, and for the reasons I have outlined above, we have been able thus far to meet the nation's military needs. It is important, however, to repeat the caution voiced during the 1977 hearings by one of my predecessors as Director of Los Alamos, Harold Agnew:

> ....if you believe that there will be requirements for new untested designs of yields considerably larger than 150 kt, then, if the treaty is ratified, our defense systems eventually will have to bear a penalty in payload weight, physical size, and perhaps even in the additional use of fissile materials. These penalties will accrue because under the treaty the high-yield warheads of the future will of necessity be the same ones which have been developed in the past.

To a significant extent, Agnew's prophecy has been fullfilled, although the penalties thus far have been manageable.

The basis for weapon certifications by the laboratories has changed in a significant way from that of earlier years, when judgments could be more directly tied to full-yield tests of at least near-weaponized devices. It now rests heavily on indirect evidence obtained in partial-yield tests, interpreted by skilled designers. The element of risk in this process obviously increases as the basis in test data is reduced. (However, the moratorium of 1958-61 demonstrated that new military requirements continue to arise, and higher risks are accepted, when testing is completely suspended.)

One result of this change has been increased emphasis on stockpile confidence testing, although, as I already have noted, a significant number of these tests have themselves been adversely affected by the treaty limit on yield. In the past, such tests have been essential in certain cases to assess the effects of prolonged exposure to the stockpile environment (such as aging) on a weapon, or to answer other reliability questions that may have been raised in the course of the on-going test program. In other equally important cases they have served to confirm the validity of the many practical decisions made during the translation of a tested physics design into an actual stockpile weapon. It is no longer possible, however, to test a warhead's full performance when the intended yield of the weapon lies above the TTBT limit. In such cases, which include the most important designs we have added to the stockpile since 1977, the weapon must be modified from its stockpile configuration before testing. What is tested, therefore, is not what is in stockpile.

These facts tend to increase the already great reliance we must place on the judgments of experienced designers. Their judgments are informed chiefly by current and older test results pertaining to the specific systems involved, but the relevant test experience is receding into the distant past.

This last point becomes a serious concern mainly as I look toward the future. In recent years, we have relied heavily on components of a few older tested designs, and it is probable that some other requirements, should they arise, can be met in the same way, with increasing penalties. It is evident, however, that the test experience on which new adaptations of these older designs is based is being eroded by time. Some of the key individuals involved in their development already have retired or gone on to other work.

The link with direct test experience in the high-yield range thus is becoming increasingly tenuous. This fact, of course, creates the imperative that we resist any deviations from that experience as we adapt it to new requirements, but the resulting conservative policy inevitably leads to the penalties predicted by Agnew.

Finally, it is becoming clear that certain weapon requirements now under study by the DoD and the DOE laboratories may well prove to be beyond the reach of the older tested design technologies. As I have noted already, these requirements are determined in most cases by the changing nature of the targets (e.g., hardened, dispersed, relocatable) that must be held at risk if stable deterrence is to continue. They are augmented, however, by our continuing concerns regarding weapon safety and security and our continuing emphasis on improved command and control. While I am optimistic about our ability to respond to some of these needs under the TTBT constraints, it must be recognized that success cannot be guaranteed in all cases.

To summarize, we have been able thus far to meet our responsibilities to contribute to the nation's deterrent under the testing limit imposed by the TTBT, even though the requirements that have had to be met for new high-yield weapons have exceeded those explicitly foreseen in 1974 and 1977. We have met our responsibilities only by using old, previously-tested designs. I should point out to the Committee that this statement of having met responsibilities would not be possible today if the yield limit for tests had been significantly lower during the past decade, nor, I believe, will it be possible a decade hence if increased restrictions are invoked, unless there has been a fundamental change in the requirements for nuclear deterrence.

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Let me turn now to the question of verification. Much of what is new since 1977 with regard to the treaties under consideration lies in this area. As I said at the beginning of this statement, I fully support the President's decision to make the agreement on improved verification measures a condition for their ratification. My purpose here is to give to this Committee a brief outline of the technical basis for my own belief that verification must be improved if the benefits of these treaties are to be realized.

I would consider verification of compliance with these treaties to be effective and adequate if neither side can obtain a significant military advantage through clandestine violations that cannot be overcome by the other side without violating the treaties. At present, verification of the TTBT does not meet this standard, nor would it following ratification unless essential changes are made in its provisions.

The record clearly shows that verification concerns played a significant role during negotiation of the TTBT in 1974, and an even greater role in the subsequent PNET negotiations during the next 18 months. They also were the focus of much of the testimony in 1977, which was uniformly optimistic that the problem of verification was well in hand. Subsequent events and the experience of the last decade have changed this picture considerably.

The point I wish to emphasize most strongly is that the current debate over <u>past</u> Soviet compliance or noncompliance is not the main verification issue that should be considered in the ratification debate. Instead the fundamental issue is how can we effectively verify compliance in the future? You will, I am sure, hear arguments on both sides of the question of past Soviet compliance. Usually these arguments revolve around the question of the proper bias to apply to our teleseismic interpretations of signals from Soviet tests. But it is important to understand that changing the bias, as has been done several times in the past, can only shift <u>inconclusive evidence</u> slightly in favor of a verdict of compliance or slightly in favor of noncompliance. The evidence still will be inconclusive, because of the inherent statistical uncertainty in teleseismic yield estimation.

The event most often cited in recent discussions of concern about TTBT verification is an abrupt upward change in the observed pattern of seismic signals coming from the Soviet test site at Semipalatinsk. This jump was unforeseen at the time of the 1977 hearings. It occurred about a year after a comparable downward adjustment in our way of estimating yields from the seismic signals. Before the change was made, several 1976-78 tests appeared to be violations, but with the new "bias correction" this no longer was true. The present concern, however, results from Soviet tests <u>after</u> the bias change. The new troublesome pattern continued until the Soviets suspended their test activities last year. There has been a great deal of debate about the significance of this test pattern and whether or not it proves Soviet noncompliance with the TTBT limit.

The view of my colleagues who have worked hard on this problem is that the only conclusion possible is that reflected in the old Scotch verdict: Guilt not proven. But neither is innocence, which is what verification requires. The pattern of Soviet testing is consistent both with substantial (that is, approximate) compliance, especially after the most recent revision downward of our official yield estimates, but it also is consistent with militarily significant violations. There is no marginal further change in seismic interpretation that can shift the weight of evidence decisively one way or the other, in my view.

Thus the essence of the verification question now before this Committee is not whether the Soviets have violated the limit in the past but rather the fact that, unless changes are made, I believe they will have the ability to do so in the future. The key issues, of course, involve the questions what is a militarily significant violation, and what changes are required?

With regard to the first of these, a most important technical change has occurred since 1974 and the earlier hearings in 1977. There has been steady evolution and vigorous deployment of new Soviet strategic weapons, the most threatening of which now consist almost entirely of exceedingly accurate MIRVs, an evolution that could not have been predicted reliably in 1974. At the time of negotiation of the TTBT, most Soviet missiles carried large single warheads in the several-megaton range. Our MIRVs were balanced against this Soviet force of much greater throw-weight to establish essential equivalence, or parity. The optimism that the Soviets would exercise restraint in MIRV deployments was proved wrong. Modernization of Soviet forces has threatened the rough parity of 1972. The present Soviet MIRV weapons have much smaller yields than those of the weapons deployed in 1974, increasing the significance of smaller violations of the TTBT limit.

It could reasonably have been argued in 1974 that, with Soviet strategic weapons in the range of several megatons yield, violations of the 150 kt limit by factors of two to three would be of little military significance. At least one government study at the time concluded that the Soviets could test at two or more times the 150 kt limit, but this evidently was judged to be relatively unimportant then. We know now, as a result of our analysis of the statistics involved, that the problem is even worse than the 1974 study suggested; the experience of the past decade confirms our conclusion that a seismic yield estimate would have to be well above twice the threshold limit before a substantive response was likely to result. But with the majority of Soviet ICBM yields now in the 500 kt range, a violation at

the 300 to 450 kt level can no longer be dismissed as having little military significance. This is particularly true at a time when changes in the targets we must hold at risk may require entirely new, untested designs in the same yield range.

The ability to conduct such tests, at least occasionally, cannot be denied the Soviets under the present treaty provisions, even after the exchange of data that will follow ratification. On the other hand, the U.S. has scrupulously complied with the 150 kt limit. Since both sides have strategic weapons requirements well in excess of this limit, violation of the limit by the Soviets could create an asymmetry that has significant military implications. Even the most confident resolution of such questions as the correct value of teleseismic bias between test sites cannot alter the fact that future Soviet compliance cannot reliably be assured by national technical means alone, even if these are "calibrated," as some have proposed. To provide assurance of compliance at yields much closer to the treaty limit requires the negotiation of additional verification measures having the capability of those proposed to the Soviets by the President. Without such measures, there can be no assurance that militarily significant violations of the limit are precluded in the future.

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I would like to briefly discuss the work we have been doing at Los Alamos to support the President's decision to seek improved verification of compliance with the TTBT limit.

The U.S. has proposed to the Soviets to have on-site observation by each country of tests by the other that are expected to be in a yield range where compliance questions might reasonably be anticipated. Thus there would be a lower limit below which such observations would not be necessary; in my view this limit must be chosen rather carefully in order to provide effective verification without unduly impinging on the test activities of either side.

The proposed observations would consist of on-site measurements of the position of the rapidly expanding shock wave that is produced by the nuclear explosion. The result of the measurement and its interpretation is called the "hydrodynamic yield" of the explosion. Under certain conditions, the yield can be inferred very accurately from such measurements, e.g., CORRTEX; those conditions are well-understood, and, of course, they must be provided for in Protocol language that is drafted with great care.

There is a very long history of successful U.S. underground yield measurement by this method, over the entire yield range from sub-kiloton to Megaton, in simple as well as extremely complex test configurations, and in the particular geometry proposed for weapons test yield verification measurements. We believe it is thoroughly understood and already used in some form by the Soviets. Moreover, this same method was the basis of the successful negotiations in 1974-1976 that resulted in the very elaborate verification Protocol to the PNET that this Committee now has before it.

This elaborate Protocol makes the PNET, with small changes as may be required if the TTBT verification is improved, effectively verifiable. However, I must caution that this is true only if the TTBT threshold remains 150 kt. If there are further restrictions on weapon test yields, the permitted PNE yields must be correspondingly lowered. Otherwise, even a perfectly legitimate peaceful explosion can be used to obtain military benefits unobtainable in a weapons test.

The problem we have been working on for several years at Los Alamos is that of applying the on-site hydrodynamic technique to the limited objective of weapons test verification under the 150 kt limit. It goes without saying that there are important new problems that arise when weapons tests, rather than explosions for peaceful purposes, are the subjects of such observations. We must not interfere with the test objectives of either side; some of the provisions in the PNET Protocol would do so. Neither can we allow the slightest compromise of sensitive classified information. This was a concern also for the PNET, but the problem was more easily solved. Finally, we must devise a plan that effectively protects us from being "spoofed," even in complex test geometries that were precluded under the terms of the PNET. It is my belief that our work at Los Alamos has dealt successfully with all of these problems, and we now have acquired a sufficient data base through experiments conducted on our own test program to provide very high confidence that the verification objective can be achieved without compromise of secret information and without significant danger of spoofing.

To accomplish the verification objective, we have developed at Los Alamos, and thoroughly tested, a new generation of equipment that is much more capable and easily used than that which was available in 1976. I should stress, however, that the essential element in the President's verification proposal is the on-site measurement of hydrodynamic shock position, rather than the specific equipment to be

employed. While we are justifiably proud of our CORRTEX equipment, it is entirely possible that other equally capable or even better devices will become available.

I should add that we have thoroughly evaluated the verification capability that will result from employment of these measurements to solve the TTBT problem. The key questions are: what is the yield at which the Soviets can test both routinely and occasionally if this method is employed, and what is the military significance of tests at those yields? The same questions, I believe, must be answered quantitatively for any proposed alternative. The method I have discussed fully meets the requirement for effective verification that I defined earlier in this statement.

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In summary, I favor ratification of the TTBT and PNET with the provision of improved verification. The United States should insist on a verification protocol that does not allow the Soviets to test at a level above the threshold limit at which they can achieve a militarily significant advantage. It is important to note that all testing restrictions lead to technical risks and potential military penalties. The TTBT restrictions to date have been manageable, but there is concern about the future. Testing constraints more restrictive than those in the TTBT would greatly endanger our ability to adequately support the Nation's deterrent in terms of safe, secure, reliable and effective nuclear weapons.

Senator EXON. Thank you very much gentlemen.

As I mentioned earlier, if we have questions that require going into a closed session, we have a room that is just around the corner and down the hall, SR 232A, which has been cleared, and we can go there if that is necessary. Senator Thurmond said that he might have some questions that would require that.

We will proceed under the 6 minute rule and try to move on.

SOVIET VIOLATIONS

Dr. Batzel, in your statement, you say that it is impossible to state with certainty that the Soviets have or have not violated the treaty. The administration continues to insist that it is likely that the Soviets have violated the treaty.

This seems to me to be a significantly different position between the experts at Livermore Laboratory and the position of the administration.

Can you explain to me where you think the administration is getting its information? It seems to differ significantly from your assessment.

Dr. BATZEL. It is a question of looking at the available data, and to the first approximation, we have the same data set. And then it is looking at the information, the teleseismic information and making the analysis.

My statement is that we don't know.

Senator EXON. No one knows for sure.

Dr. BATZEL. We don't know.

Senator EXON. No one.

Dr. BATZEL. Our view is that no one knows for sure.

Senator Exon. Dr. Hecker, what is your answer to that?

In your statement, you said that the pattern of Soviet testing is consistent either with substantial compliance or militarily significant violations. Which do you think is a more likely case?

Do you and your organization tend to agree more with the interpretation that has been stated by Dr. Batzel? Or, do you and your organization tend to agree more with the interpretation that is placed on this by the administration?

Dr. HECKER. Unfortunately, the problem is one of statistics, and a scientific analysis of the statistics simply says that we cannot tell.

That is really the answer that I have to give.

It is consistent, indeed, with both substantial compliance, but also with occasional noncompliance.

The uncertainty of the teleseismic evidence alone is such that one simply cannot state it more clearly than that.

So, anything else that I would give you is really not a scientific answer to a question that has to be treated scientifically, and that is that, statistically, you simply cannot tell.

Senator EXON. Thank you for your answer. But that does not help a nonscientific person, who has to make these tremendously important decisions, a great deal.

If you would like to expand on that any further without taking a position that you are not comfortable with, I would be glad to listen to you.

You know, what this hearing is all about is to look at the military significance of all of this. I listened very carefully to you and you made it very clear in your statement that you backed up the previous witnesses with regard that if the Soviets were exceeding these limits, it could be a significant step in their favor.

Let me ask you this question to try to get at the bottom of this.

STAYING WITHIN TREATY LIMITS

We have always lived within the 150 kiloton limit. Are we so good and so accurate that we never make a mistake?

It seems to me that this is an uncertain science. Both the United States and the Soviet Union could exceed the 150 kiloton limit by accident, or having a nuclear explosion that was considerably less or considerably more than they had anticipated.

It seems to me that, if we are so good that we can never go over the 150 kiloton limit, we could be able to do a somewhat better job than we seem to be doing in anticipating what the Soviets are or are not doing in degrees of compliance.

Dr. HECKER. Let me tackle that.

There are two reasons that one can stay within the limits of the treaty. One is that, naturally, it forces us to be more conservative in terms of what levels we test at. Second, the treaty language does allow for the fact that, occasionally, there might be, let's say, an accidental slight increase over the 150 kiloton limit.

So, it basically works because the treaty includes language to make sure that one stays within the spirit of the treaty.

But let me go back and try to do a better nonscientific job of answering your first question.

Probably as far as I can state it, within the current uncertainties I have sufficient concern, and that is what I expressed in my statement to you, about Soviet compliance so that I feel we need more effective verification in the future. That is why we strongly support the on-site CORRTEX measurement.

I simply feel that the whole question of uncertainties is such that we cannot make sure that there will not be militarily significant violations.

So, yes, I have considerable concerns about their compliance.

Senator EXON. Than you, gentlemen. Let me ask you my last question, and let me try to phrase it in this fashion.

It is always difficult for people who work on different wavelengths—you scientists work on one wave-length and we nonscientists, who have to take part in these important decisions, work on another wave-length.

With your scientific knowledge and with the concerns that you both have expressed here—and I share many of them—as scientists, and not political leaders, what would be your solution to work our way out of the difficulty? I suggested earlier that maybe we could have some kind of arrangement where we would not press this now but say, we are going to go along with it for one more year in our present posture while getting together with the Soviets on some joint changes of the agreement, which would better satisfy both sides that one side is not exceeding the limit.

Give us your political evaluation of that.

Dr. BATZEL. I find it difficult to give a political evaluation. I can make a suggestion that technical discussions with the Soviets on CORRTEX in the Geneva discussion, I think, would forward progress in this area of verification. It seems to me that is a very reasonable step to take and one that is available to us and should improve our understanding, our joint understanding, of the verification problem.

Senator EXON. Thank you.

My time is up.

The chairman must not go over his own rule, so could you give me a brief answer to that, Dr. Hecker?

Dr. HECKER. Yes.

I would encourage you to take the path that does bring the Soviets to having meaningful technical discussions, and I would also, at the same time, continue the entire system, to continue research to make the verification procedures better.

Senator EXON. Thank you very much.

Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

Dr. Hecker and Dr. Batzel, we are glad to have you here. I want to ask this question of each of you.

EFFECTIVE VERIFICATION VITAL TO NATIONAL SECURITY

Each of you has concluded that ratification of these treaties with effective verification is in our national security interest. Could each of you summarize the major factors that brought you individually to that conclusion?

Dr. BATZEL. From the point of view of the United States, the 150 kiloton limitation has left us in a position where we can meet the military requirements, as stated by the Department of Defense.

When one looks at the feasibility of higher yield tests, for example, the United States is limited to yields considerably less than a megaton because of our test location.

The Soviets have the option of testing at higher yields at one of their test sites. So there is a limitation on them. If there were no agreement, there would not be a limitation on their doing very high yield tests.

So I think there is a benefit to the United States of the Threshold Test Ban Treaty.

Senator THURMOND. Thank you.

Dr. Hecker.

Dr. HECKER. Let me take a slightly different tack in terms of answering why is ratification in the national interest.

The reason I feel it is in the national interest is we are favoring ratification with improved verification by CORRTEX. What this will do is force both sides to play the game by the same rules, and that is, to observe the limit close to the 150 kilotons.

Without that additional vertification, as I pointed out, currently we could not deny the Soviets the ability to test considerably higher, and, in my opinion, that can have military significance.

So, in the national interest, it is because of the improved verification procedures.

Senator THURMOND. I have another question for each of you.

ADDITIONAL WARHEAD DEVELOPMENT COST

Is there additional warhead development cost associated with fielding weapons above 150 kilotons under a threshold test ban regime, and can you comment on any additional risks associated with such developments?

Dr. BATZEL. There is additional cost because of the requirement to extrapolate from yields under the 150 kilotons, to higher yields. We have to do parts of the nuclear warhead in separate experiments.

And so, we do more experiments in order to make sure we know where we are from a reliability and predictability point of view.

There is additional uncertainty. We believe that uncertainty is acceptable.

Senator THURMOND. Dr. Hecker.

Dr. HECKER. As far as the cost is concerned, I agree with Dr. Batzel's statement. I think probably, though, at this particular time, if integrated over the entire cost of the system, that would be reasonably small.

However, on the risk aspect, the major risk is that we are currently forced to design the high yield strategic systems based on old technology. And so, we tend to be more conservative in our design philosophy currently than we could be if we did not have to observe that limit.

So, the penalty is one of conservatism. I think, in terms of potential military significance so far, it has been manageable to date.

Senator THURMOND. Now I have another question for both of you.

SAFETY AND SECURITY IN NUCLEAR WEAPONS

Does the increasing interest in safety and security of our nuclear weapons add additional risk to our ability to field weapons above 150 kilotons?

Dr. BATZEL. It adds additional requirements for nuclear tests because the safety and security measures we take involve the details of the nuclear design. It involves additional experimentation. After those tests are complete, we believe we have demonstrated the reliability of those particular systems and that we have not increased the risk.

Senator THURMOND. I have a couple of additional questions for the classified hearing. That is all I have at this time, Mr. Chairman.

Thank you.

Senator EXON. Thank you.

Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

Gentlemen, welcome.

SOVIET NUCLEAR TESTING

I will like to ask each of you whether you are able to say that Soviet nuclear testing activities for a number of tests constitute a likely violation of the obligations in the Threshold Test Ban Treaty.

I think that you commented to some extent on this this morning already. But I want to ask you the direct question: are you able to say that the Soviets have likely violated the treaty?

Dr. BATZEL. I have said, and I think there is no reason to change, that it is impossible to state with certainty that the Soviets have or have not violated the TTBT. That is my view.

Senator LEVIN. But that is not quite my question.

My question is are you able to say that they have likely violated?

Dr. BATZEL. The answer is no.

Dr. HECKER. Again, my specific statement was that the statistical evidence indicates substantial compliance, but it also does not preclude going above the limit. So, again, statistically, we have just gone through this argument, that we are not able to say whether the Soviets have likely violated. It is consistent with both compliance and with violation.

Senator LEVIN. The short answer to my question as to whether you are able to say that they have likely violated the Threshold Test Ban Treaty, then, is no?

Is that the short answer to my question? You cannot say that they have likely violated the treaty.

Dr. HECKER. I cannot say that. That is correct.

Senator LEVIN. All right. That was a straight-forward question and a straight-forward answer.

Has the administration asked you for your opinions, because they told us something else.

Dr. BATZEL. We have provided our technical opinions.

Dr. HECKER. If I may just add, we have provided our technical opinion. The reason that you seem to be getting contradictory answers is that the question is not a simple question.

Senator LEVIN. I try never to ask simple questions.

Dr. HECKER. The question is, indeed, based on a statistical analysis of very complex problems, and so you get different scientific opinions and then different lay opinions.

Senator LEVIN. The conclusion may be a complicated conclusion, as to whether or not you can say there has been a likely violation. That involves a lot of weighing of evidence.

My question is a very straight-forward question and you have given me a straight-forward answer. You are not able to say what the administration has said, and I think we all ought to be aware of the lack of technical support, in these two labs, at least, for the administration's conclusion here. But that will speak for itself.

My next question——

Dr. HECKER. Senator, if I may just add—and I realize you did not ask the question——

Senator WILSON. And he doesn't want the answer either.

Senator LEVIN. Supply that for the record, or maybe Senator Wilson can ask the question.

Senator WILSON. I will ask the question.

Senator LEVIN. Dr. Hecker, your written testimony today, which I presume is part of the record—is that so, Mr. Chairman? Their statements will be made part of the record?

Senator EXON. Yes.

Senator LEVIN. Dr. Hecker, you say there has been a recent revision downward of our official yield estimates. That is your public testimony?

Dr. HECKER. That is correct.

Senator LEVIN. Now, when I asked Dr. Barker that question, he said that he could not say anything about that in open session.

Are you comfortable in saying that in open session?

Dr. HECKER. It was indeed our understanding that that statement is unclassified, as it stands, and, indeed, we did run it through our classification people and DOE classification people.

I might add that that is pretty much as much as one can say in an unclassified forum.

Senator LEVIN. Well, it is helpful to be able to say that much anyway, that we have revised downward.

A newspaper article a year ago reported that the President signed a National Security Decision Directive instructing a review of the allegations of Soviet noncompliance in light of these downward revisions of yield estimates.

My question is do you know whether or not that Presidential directive has resulted yet in a report to the President?

Dr. HECKER. I cannot shed more light on that subject than was done this morning.

Senator LEVIN. Do you know whether that report has been completed?

Dr. HECKER. I do not know.

Senator LEVIN. Dr. Batzel.

Dr. BATZEL. I do not know.

Senator LEVIN. Dr. Batzel, since the limits were agreed to in the TTBT, do you know how many U.S. tests have had magnitudes such that their yields, as estimated by seismology, have exceeded 150 kilotons?

Dr. BATZEL. I could provide that information for the record. I will have to look to see whether that is classified or unclassified.

Senator LEVIN. Well, is it safe to say that some of our tests, as estimated by our own seismology, have exceeded the 150 kiloton limit?

Dr. BATZEL. The answer is yes.

Senator EXON. Are you telling me that we have violated the 150 kiloton limit?

Senator LEVIN. Oh, no, no. I am saying that the seismology has told us that our own tests have done it.

The next question is have we ever violated the limit?

Dr. BATZEL. No.

Senator LEVIN. Our own tests have been within the limit. I have no doubt about that. I mean, I've got to believe that. If our Government and our lab directors tell us that we have not exceeded that limit, I have to believe that we have not.

I don't care about Iran or anything else. I believe it when they tell us we have not exceeded the 150 kiloton limit. And yet, our own seismology has said that we have.

Dr. BATZEL. There is still the major uncertainty, the factor of two, in teleseismic measurements that you cannot get away from.

Senator LEVIN. That's fine. But it also says something about our conclusions about Soviet tests.

Senator WILSON. Are you asking me that question? You are looking at me?

Senator LEVIN. No, I am just looking at you.

Senator WILSON. I would be happy to answer, you know?

Senator LEVIN. My time is up.

PROBABLE VIOLATIONS

But it seems to me that we have our lab directors, who say they cannot join in the conclusion that the Soviets have violated the limit. Our own seismology is uncertain about whether we have violated the limit. And yet, we got a report last year, and I presume this year, saying that, in likelihood, the Soviets have violated the limit. I presume that, if they wrote a report, they could then say that in likelihood the Americans have violated the limit.

I think the honest answer is we don't know for sure. That is the honest answer. We cannot say with certainty because our own seismology is not accurate enough on our own tests that we can say with certainty.

We are going to have another report, I don't doubt for a minute. And it is overdue, by the way. We are going to have another report which is going to say that in likelihood, the Soviets have violated the treaty.

That is the problem I have.

I know the seismology is not perfect. We know the problems. It requires interpretation and so forth. But it is because of that that it seems to me you cannot say that in likelihood the Soviets have violated this treaty any more than you can say that we have violated the treaty. That is the problem.

Senator EXON. Senator, we will be going into closed session and you can ask that question in just a few moments. In fact, I hope we can go into it in about 6 minutes.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

Mr. Chairman, let me say, first, that I am very pleased to welcome both of these directors, both these gentlemen, Dr. Batzel and Dr. Hecker. They give me very high confidence in the quality of the work that is being done at the national labs which they respectively direct.

Second, it seems to me that the straightforward question and straight forward answer from my colleague have produced, I think what we can stipulate to, and that is the inadequacy of teleseismic measurements as a means of verifying compliance.

Senator LEVIN. With certainty.

Senator WILSON. With technological certainty. I don't think that there is any question about that or that anybody is professing anything else. But I don't think that, in and of itself, necessarily invalidates the assessments that have been made with respect to compliance because those have taken, as an element, the technological interpretation that is possible, and supplemented that with a great deal of intelligence from a variety of sources. In other words, the technology is but one element in that overall evaluation.

I think, before you can suggest that the noncompliance reports are invalid, you would be required to invalidate the intelligence that has gone into that judgment.

Now that we have established the limitations of teleseismic technology, let me ask both of you gentlemen if you were directors of the Soviet national laboratories, and, in fact, were engaged, as you have suggested we should engage them, in discussions of a technological nature on verification, if you were asked to respond to an American proposal for a CORRTEX, could you give me any valid objection to your agreeing to that system being employed as the means of bringing verification?

Dr. BATZEL. The argument could be made by that laboratory director that the CORRTEX measurement or any other on-site measurement would complicate his life with respect to execution of an experiment.

Senator WILSON. Well, that's just too bad.

Dr. BATZEL. I agree. And so, from our point of view, that is acceptable. You just asked me what the Soviet director might say.

Senator WILSON. Yes. And I'm sorry, I should not be discourteous to you.

Dr. BATZEL. I wanted to make one other comment about my statement.

My statement is not inconsistent with the administration's position of probable violation. I cannot say either way.

Dr. HECKER. If I may pick up on that point as well—and it is unfortunate that Senator Levin has left—because of the nature of his question, he made his point. But, I think as Dr. Batzel just pointed out, we would also have to say that if you would ask the question, "do you have any data that would say your point of view is inconsistent with the administration's finding that there is likely violation," what we could say is no, we do not have any data that is inconsistent with likely violation.

So, depending on how you ask the question, you will get your answer.

The point is exactly the one that you made: the uncertainties are such with teleseismic means that we need something else.

The President has proposed CORRTEX, and to answer your question, specifically from my standpoint, the Soviet lab director could say, first of all, that it makes his life more difficult and, second, he would have to be worried about the question of is it intrusive in terms of his testing.

We have spent considerable time worrying about the intrusiveness from our own concern, and we feel that we can answer those questions so that the CORRTEX technique will not be intrusive.

Senator WILSON. Thank you, Mr. Chairman.

Thank you very much, gentlemen. I will see to it that Senator Levin has benefit of your answer.

Senator EXON. Thank you, Senator Wilson.

We are going to recess in just a moment. I have some questions that I will submit for the record which I would like to have you reply to as soon as you can.

The record of this meeting this morning and our hearings this afternoon will remain open for 48 hours for any comments, questions, or suggestions from members of the subcommittee.

I want to announce that we will reconvene in this room promptly at 1:30 for the afternoon session. I think it would be in order if we had a motion at this time to go into closed session, since we are in open session.

Senator THURMOND. I so move.

Senator WILSON. I second.

Senator EXON. It has been moved and seconded. Without objection, it is so ordered.

We now recess for 5 minutes and will reconvene at the previously announced room at 6 minutes after 12.

[Whereupon, at 12 o'clock noon, the subcommittee recessed, to reconvene in executive session.]

EXECUTIVE SESSION

The subcommittee met in executive session, pursuant to notice, at 12:29 o'clock, p.m., in room SR-232A, Russell Senate Office Building, Senator Strom Thurmond presiding.

Present: Senator Thurmond.

Staff present: Robert G. Bell and Robert F. Bott, professional staff members; Colleen M. Getz, research assistant; and Mickie J. Gordon, staff assistant.

Also present: Robert P. Savitt, assistant to Senator Cohen.

Witnesses present: Robert A. Barker, Assistant to the Secretary of Defense for Atomic Energy; Adm. Sylvester R. Foley, Assistant Secretary for Defense Programs, Department of Energy; Siegfried S. Hecker, Director, Los Alamos National Laboratory; and Roger E. Batzel, Director, Lawrence Livermore National Laboratory.

Senator THURMOND. The subcommittee will come to order.

Dr. Hecker and Dr. Batzel, I will ask you both this question.

Has the Department of Defense levied any future warhead requirement on the Department of Energy that causes you particular concern in view of continued adherence to the 150 kiloton threshold?

Dr. BATZEL. At this time, no.

Dr. HECKER. I think that I would answer you in the following fashion. We do have to live under certain restrictions, and for the current systems, I think those restrictions are manageable. I have referred, for instance, to the W-88, Trident II, D-5 development.

We have a number of nuclear tests planned, [deleted]. And, of course, we will modify the system to live within the 150 kiloton limit.

We will be able to do that, will be able to refer to a 1973 test that was done to give us the proper confidence in that system.

But we will need the capability to test to 150 kilotons.

The concern that we do have is, as we look to the future, and currently, one of the requirements that is being discussed for future systems is the ability to field earth penetrator weapons. These are weapons that would be more able to hold at risk the targets that the Soviets have deeply buried. And for the earth penetrator development, we need to look at a different type of warhead, [deleted].

Currently, we have a test program schedule [deleted] to live within the 150 kiloton limit. It is not clear at this point that we will be able to meet the future military requirements [deleted].

We are trying to do everything within our power to design it in such a way that we will have the appropriate confidence to field a weapon [deleted].

So, our concern is mostly one for the future.

Senator THURMOND. But you do have some concern about the 150 kiloton limit?

Dr. HECKER. That is correct.

Dr. BATZEL. We need the 150 kilotons for sure.

Senator THURMOND. So, Dr. Batzel, you feel the same way?

Dr. BATZEL. Yes, sir.

Senator THURMOND. Thank you.

Does either of you have any additional comments that you would like to make on this subject?

Dr. BATZEL. From my point of view, additional constraints on nuclear testing would be unwise.

OPPOSED TO BAN ON NUCLEAR TESTING

Senator THURMOND. In other words, you are opposed to a ban on nuclear testing?

Dr. BATZEL. I am opposed to a ban on nuclear testing, yes.

Senator THURMOND. And, therefore, you oppose this comprehensive ban on nuclear testing?

Dr. BATZEL. Yes, sir.

Senator THURMOND. Do you feel that it would not be in the best interests of the country?

Dr. BATZEL. That is my view.

Senator THURMOND. Dr. Hecker, do you feel that way?

Dr. HECKER. Senator Thurmond, the things that I would like to add——

Senator THURMOND. Speak a little louder. I can't hear you.

Dr. HECKER. I will speak louder.

Senator THURMOND. Thank you. The acoustics are not very good in here.

Dr. HECKER. In the open session, we had indicated that the yields of the current systems, the U.S. strategic systems, had to be increased in the past 10 year time frame, and that we are basing the certification on tests that were done before the treaty was enacted. And so, I would like to elaborate here that those systems are systems, like the Trident II systems, like the MX, Peacekeeper, and, potentially, the small ICBM, and we are basing those on previous tests. But we definitely need the 150 kiloton limit in order to be able to have the proper confidence.

Again, as we look into the future, the requirements associated with the earth penetrator weapon, at this point we will try to live with—well, we will live within the 150 kiloton limit. We are not quite certain whether we will meet the military requirements.

I also agree, therefore, that further testing restrictions are not consistent with the way the military requirements have changed in the past 10 year time frame. And so, I also think they are not in the best interests of the country.

Senator THURMOND. You feel the same way, I presume, Dr. Batzel?

Dr. BATZEL. Yes.

Senator THURMOND. Now, Dr. Barker, is there anything you would like to say in closed session?

Dr. BARKER. I would appreciate the opportunity to say a few words about the discussions that I have been having with the Soviet Union in Geneva on the subject of nuclear testing.

We have had four meetings with them since July of last year. The first two of those sessions, the session in July and the session in September, consisted of sound technical discussion [deleted].

Senator THURMOND. As a system, it will enable you to detect the strength, so to speak, or the power of the test?

Dr. BARKER. Correct. [Deleted.]

We met again in September, and, again, [deleted].

Senator THURMOND. Are they familiar with CORRTEX?

Dr. BARKER. They should have been familiar with an earlier system similar to CORRTEX [deleted]. So they knew some aspects of it, [deleted].

But I can say that I believe it is a very important ingredient of that. [Deleted.]

We really need the support of the Congress as a necessary ingredient.

Senator THURMOND. I guess you couldn't say that in public to that extent, could you?

Dr. BARKER. I cannot be as emphatic in public as I can right here.

Senator THURMOND. I wonder if you shouldn't talk to the chairmen of both committees, in the Senate and in the House, and several other prominent members who are interested in this field and tell them just what you have told me.

Dr. BARKER. I would be delighted to.

Senator THURMOND. I think it would be very worthwhile to do that. I can see exactly what you are saying, that if they feel they can wait to see what the Congress does, the Congress is going to hamper our effort. Of course, that is what they want.

Then they will just hold out.

Dr. BARKER. I think all of the ingredients are in place and it is a political judgment to get us into the process of negotiations.

Senator THURMOND. Well, if you had to stay here for 2 or 3 days to see the chairmen of both committees and some of the leaders who are interested in this field, I would advise you to do it.

Dr. BARKER. I will be available.

Senator THURMOND. Oh, don't be available. You contact them.

You contact them and tell them just what you have told me. These people around here are so busy that if they can shun seeing anybody, they will do it because there is always somebody else to see. But they have nobody else to see that is more important, I think, than to see you on this. That is extremely important.

Dr. BARKER. Thank you, Senator.

Senator THURMOND. Does anybody else have anything?

[No response.]

Admiral Foley, do you have anything else?

Admiral FOLEY. No, sir, except, if I may, I would just put it into the context of our discussion of the violation/nonviolation, and whether the Soviets did or didn't violate. That is ancient history, in my judgment, and not important.

What is important is to insure that, in the future, the Soviets do not violate the treaties if we are adhering to them.

So, verification, to me, is the fundamental issue with regard to these treaties.

Now, I do not speak for the administration. I will speak for the Department of Energy and say that technically, we need verification. The mechanics of how the Senate goes about insuring this verification I leave to the administration and to you all to work out, sir.

But, to me it is most important that we have adequate verification, and then we can get on with additional confidence-building measures and arms reductions.

Senator THURMOND. Well, it would be helpful if you could talk to these people, too, as I just mentioned to Dr. Barker.

Admiral FOLEY. Gee, I thought I was going to get out of that one.

Senator THURMOND. You see, you are now the top man in this in the Energy Department.

Admiral FOLEY. I will attempt to tie in right on with Dr. Barker, sir, and to do just as you have suggested.

Senator THURMOND. You are the head man over there, now, in the Energy Department. There is nobody above you on this subject. Secretary Herrington is going to have to look to you. He may sign the papers, but you are going to do the work. You are going to make the decisions. You are a very important man.

I think it would be very helpful if you could talk to these people, too, along that line.

Admiral FOLEY. Yes, sir.

Senator THURMOND. Thank you very much.

Is there anybody else who has anything to add? Anyone else?

[No response.]

Well, I want to thank all of you for your appearance here. To me, it is just amazing that some people take the position that they do here in the Congress.

I just don't understand them. But they do it, and we have to try to overcome it. That is the reason I am so anxious for you to get to these Senators and Representatives and tell them directly, especially where you have dealt with the Soviets in negotiations, and they are just waiting to see if the Congress is going to help them out or whether they are going to have to come to the table and go to the mat with you. That is what it amounts to.

Well, I think we will close this hearing.

Thank you very much. This meeting is now closed.

The afternoon open session will begin at 1:30 p.m.

[Whereupon, at 12:42 o'clock, p.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

AFTERNOON SESSION

[Whereupon, at 1:32 p.m., the subcommittee reconvened, Senator J. James Exon (chairman) presiding.]

Senator EXON. The subcommittee will please come to order.

I would say that I appreciate the witnesses for our first session of this afternoon already being at the witness table.

Let me start out by saying the subcommittee meets this afternoon to resume its open session on nuclear testing limitations.

We will now hear testimony from three witnesses who will address some of the issues raised in this morning's session. I anticipate that we will have some differing points of view.

First, we will hear from Milo Nordyke, leader of the Treaty Verification Program at Lawrence Livermore. Mr. Nordyke is appearing in an individual capacity. Let the record show that he is here in an individual capacity and will discuss his thoughts on how to make the TTBT and the PNET effectively verificable.

Next we will hear from Dr. Paul G. Richards, of Columbia University, who is one of the Nation's leading seismologists.

Last, we will hear from Dr. Frank von Hippel, Chairman of the Federation of American Scientists, a distinguished physicist in his own right. Dr. von Hippel has recently returned from the Soviet Union, where he engaged in extensive discussions with the Soviets on this nuclear testing issue.

Bearing in mind that the subcommittee has a classified hearing on this subject in S–407 at 3 o'clock today, I would ask the witnesses to present their opening statements in about 10 minutes, if possible. I suggest that we withhold questions until all three of the witnesses have made their statements.

The full statements that you have submitted to us will be and are now accepted as part of the record. We will ask that you proceed at this time, gentlemen.

If it is agreeable with the three of you, we will begin with Mr. Nordyke.

STATEMENT OF MILO D. NORDYKE, LEADER, TREATY VERIFICATION PROGRAM, LAWRENCE LIVERMORE NATIONAL LABORATORY

Mr. NORDYKE. Thank you very much, Senator.

Verification of any treaty, such as the Threshold Test Ban Treaty, which involves the measurement or the counting of some variable, such as yield, requires that you deal with uncertainty. That is true regardless of how accurate or how precise the measurement system is.

Moreover, the problem is somewhat compounded by the fact that there are two types of errors involved—what we would call random errors and systematic errors.

The evaluation of compliance with TTBT thus involves two issues. The first is whether the yield-magnitude relationship that we are using is correct for the Soviet tests, or is there some systematic differences between our test sites and the Soviet test sites. The second issue is how should we deal with the random errors that are inherent in a seismic magnitude determination.

With regard to the first issue, the possibility of systematic errors, the key question is whether the magnitude-yield relationship developed for explosions at the Nevada test site is valid for explosions at the Soviet test site.

Seismic research at Livermore and elsewhere as early as 1973, or earlier, well before there was any thought being given in the arms control community to the subject of a yield-based treaty, indicated the existence of significant difference in the character and the amplitude of the seismic waves from Soviet nuclear explosions.

Over the last 10 years, close to 20 different seismic studies, utilizing a variety of techniques and different seismic waves and different investigators have been carried out, and virtually all of these studies have shown that the seismic magnitude from an explosion at the Soviet test site will be larger than the seismic magnitude for the same explosion carried out at our own test site in Nevada.

This means that yield estimates for Soviet explosions will be about 40 or 50 percent of the yields that you would obtain using that same magnitude in the NTS magnitude-yield relationship.

This has been called a bias. Because the effect of this bias correction is to shift the entire body of all the data up and down, depending on what value of bias you use, it has a major impact on your view of the question of compliance.

The second issue is the one of random variations in the seismic data. Random variations can make an estimated yield appear to be either smaller or larger than the actual yield, even if the bias, the systematic error, is known.

For example, if we were to carry out a series of explosions, say 50 explosions, with the actual yield of 150 kilotons, half of them, or 25, would look like they were smaller than 150 and the other half would look like they were bigger than 150.

You are always going to have to deal with this random uncertainty. The occurrence of a yield that is above 150 kilotons does not, in and of itself, necessarily imply a violation.

The existence of these random errors in the measurement system means that the issue of compliance must be dealt with in a statistical framework.

Based on our assessments of the best relationship between yield and seismic magnitude for the Soviet test sites and the pattern of Soviet testing, we have concluded that the Soviets appear to be observing a yield limit, and the best estimate of that yield limit is that it is consistent with TTBT compliance. However, because of the statistical uncertainty of the yield estimates and the uncertainty in extrapolating U.S. experience to Soviet test sites, you cannot rule out the possibility of a number of Soviet tests that may have exceeded the number.

Thus, the United States finds itself in a situation where it is observing the 150 kiloton limit of the TTBT, but we cannot reach a consensus whether the Soviet are or not. You have heard a variety of opinions this morning.

Some believe that the pattern of Soviet testing is consistent with the observance of the limit, and, when proper account is taken of the geological differences believed to exist between the Soviet test sites and our own, that this limit is 150 kilotons.

Others reject this analysis and seismology in general, and believe that the Soviets are systematically cheating by a factor as large as two or three.

So, the failure to ratify these two treaties has denied us a considerable body of data which is designed to improve our ability to estimate Soviet yields. These data include geophysical, geographical data, and, more specifically, the yield of two calibration events at each geophysically distinct testing area.

Unfortunately, the treaty or its protocol provides no language, no provision for verifying that data, and, in particular, for not verifying the yields. Unfortunately, yields, which are handed over as numbers on a piece of paper, are almost worthless for purposes of calibration.

Therefore, some enhancement of the verification provision should be considered, in my opinion, to rectify this defect.

The most straightforward approach for rectifying this defect would be to verify the yields of the calibration explosions with on-site hydrodynamic yield measurements. In fact, the procedures that are spelled out in the PNE protocol, which was negotiated in 1976 and has been signed, with some minor modification, could well be satisfactory for carrying out these calibration explosions.

This could be implemented by carrying out PNEs on the test site whose peaceful purpose would be to serve as seismic calibration explosions. Observing the drilling and the logging of the emplacement holes for these events, as provided for in the PNE Treaty, would serve to provide confirmation of the geological data exchange package, at least in the vicinity of those calibration explosions.

An alternative approach which would significantly reduce the random uncertainties would be the on-site hydrodynamic yield measurement of all weapons tests above some yield, such as 75 kilotons, which is an approach you have heard something about this morning.

So, there are really four options that are available to the United States for action on the TTBT and the PNET.

The first option, it seems to me, is to proceed with ratification of the two treaties, as they presently stand. I believe such an action would have a significant benefit in terms of the information to be exchanged and the procedures for technical dialogue and discussion that would be established as a result.

The risk, from the viewpoint of Soviet cheating, would appear to be no greater than that which exists at the present time.

I also believe that the uncertainties in seismic yield estimates, and hence the concerns about Soviet cheating, can be significantly reduced through improved analysis techniques using multiple seismic waves.

The second option is to try to negotiate enhanced verification provisions. The possibilities range from the one I suggested, of verifying the yield and the geology of the calibration explosions, using the terms of the PNE Treaty, to the administration proposal for verifying the yields of all explosions above some yield, such as 75 kilotons.

Any enhancement of our verification capability as a result of these negotiations would reduce the risk of significant Soviet cheating. The key question is how much enhanced verification is enough.

If we are not successful in getting a Soviet agreement to enhance verification, then we are left with two remaining options, neither of which, I believe, is in the U.S. interest.

The first of these two remaining options is to abrogate the treaty and resume high-yield testing.

Unfortunately, the United States is limited to about 500 to 700 kilotons at the Nevada test site, and testing above that level would require opening a new test site.

I think it is hard to be very sanguine about the prospects of that happening.

The Soviet Union, on the other hand, could promptly resume testing multimegaton devices at the Novaya Zemlya test site.

The last option would be to continue the status quo, to continue to observe the 150 kiloton treaty, but to forego the data exchange and other provisions of the two treaties.

I would say that for those who perceive the present treaty as unverifiable or who believe that the Soviets are routinely violating the 150 kiloton limit, such an option would permit the Soviets to continue the practice that they presently are following which they have followed for the last 10 years.

So, what should the United States do?

I believe that the United States, as a minimum, should press for verification of the yields of the calibration explosions provided for in the TTBT protocol. The arguments for this course of action are the following.

One, it would preserve and strengthen the very important principle, that the United States believes verification of arms control treaties should be based upon verifiable observables, and not trust.

Second, it is consistent with the Soviet view that verification agreements should be proportional to the nature and scope of the arms control agreement being dealt with.

Third, it would provide data for the validation of the seismic methodology, and, thereby, resolve the most egregious disagreements that exist within the community about the validity of the seismic methodology regarding Soviet yields and Soviet compliance.

Fourth, it would provide an opportunity for the two countries to begin gaining experience with the conduct of on-site verification activities. If we carried out the on-site verification, we would have teams going into each other's countries and carrying out the yield verifications.

Fifth, this approach would present no risk to U.S. national security beyond that which is already being accepted and would be accepted without ratification.

In summary, I would urge that the Senate provide the President with the widest possible range of options for enhanced verification so that any future opportunities that may become available for progress with the Soviet Union on the TTBT can be fully considered as a basis for proceeding with ratification.

Thank you.

[The prepared statement of Mr. Nordyke follows:]

Prepared Statement of Milo D. Nordyke, Leader, Treaty Verification Program, Lawrence Livermore National Laboratory, Livermore, California

Thank you, Mr. Chairman, for the opportunity to present my views to this committee on the issue of the TTBT and PNET and their verification. At the outset, I should like to make it clear that I am speaking as an individual who has wrestled with the problems of negotiating and verifying treaties such as the TTBT and PNET, and not as an official representative of the Lawrence Livermore Laboratory. I will briefly summarize my views on the problems inherent in verifying treaties such as the TTBT and PNET which contain quantitative limits as well as make a few comments on ways in which the verification regime for the TTBT can be enhanced.

TTBT Verification and Compliance Issues

Verification of any treaty, such as the TTBT, which involves the measurement or counting of some observable such as yield, requires that you deal with uncertainty - something that is very difficult to handle at the political level. This is true, regardless of how accurate or precise the measurement system is. Moreover, the problem is compounded by the fact that there are two types of errors involved - what scientists call "random" errors and "systematic" errors. I sometimes try to relate this problem to one of using a home scale to monitor whether you are sticking on a diet. The scale reading may vary from day to day because of what you are wearing or how long its been since you ate or because the scale sticks or other random factors, but on the average, it will give you the correct value. Unless - someone has

fiddled with the "zero adjust" knob, in which case, if they turned it up a little bit, every time you weigh yourself you will systematically, always be over your diet. Verifying compliance with the TTBT suffers from the same two types of errors - random and systematic.

Estimation of the yield of a Soviet nuclear test is based on measurements of its seismic magnitude as determined by a high-quality, world-wide network. Then, this magnitude is used with a yield-magnitude relationship based on experience with explosions for which we know both the yield and the seismic magnitude, to estimate a yield for the Soviet explosion. Evaluation of compliance with the TTBT yield limit will then depend on the two sources of error discussed above: 1) is the yield-magnitude relationship we are using correct for Soviet tests or is there a systematic difference between our test site and the Soviet test sites? and 2) how should we deal with the random errors that are inherent in the seismic magnitude determination, seismic coupling, propagation and receiving processes?

With regard to the first issue - the possibility of a systematic error - the key question is whether the magnitude-yield relationship developed for explosions at the Nevada Test Site is valid for explosions at the Soviet test sites. Seismic research at LLNL and elsewhere as early as 1973, well before there was any thought being given in the arms control community to the subject of a yield-based threshold treaty, indicated the existence of a significant difference in the character and amplitudes of the seismic waves from the Soviet nuclear explosions. I don't think this surprised any seismologists or geophysicists because there are very well-known, obvious differences in the tectonic structure of the earth between these two areas of the world.

Over the last 10 years close to 20 different seismic studies utilizing different techniques and different seismic waves have been carried out by various investigators to try to quantitatively understand this question. Virtually all these studies have shown that the seismic magnitude from an explosion of a given yield at the Soviet test sites will be larger than the seismic magnitude from an explosion of the same yield at NTS. This offset or difference has come to be known as the "bias". The estimates of the bias vary somewhat from one study to another but, on the average, they have values that

leads to yield estimates for Soviet explosions that are about 40-50% of the yields obtained from the NTS magnitude-yield relationship. Because the effect of the bias correction is to shift almost the entire body of Soviet yield esimates to lower values, the value of the bias used for yield estimation has a major impact on one's view of the question of Soviet compliance with the yield threshold.

With regard to the second issue, random variations in the seismic data can make the estimated yield of any explosion appear to be either smaller or larger than its actual yield, even if the bias is known. For example, if we were to carry out a series of explosions with actual yields of 150 kt, on the average half of them will have estimated yields greater than 150 kt, and half smaller, regardless of how accurate the measurement system is. Thus, the occurrence of a yield estimate above 150 kt does not necessarily imply a violation. The existence of random errors in your measurement system means that issue of compliance must be dealt with in a statistical framework.

LLNL was one of the first to carry out statistical studies of the question of Soviet compliance with the TTBT, based on the pattern of Soviet test magnitudes and on the best estimates of the magnitude bias.

Based on these assessments of the best relationship between yields and seismic magnitudes for the Soviet test sites and the patterns of Soviet testing, it was concluded that the Soviets appear to be observing a yield limit. The best estimate of this yield limit is that it is consistent with TTBT compliance. However, because of the statistical uncertainty of yield estimates and the uncertainty in extrapolating U.S. experience to Soviet test sites, you cannot rule out the possibility that a few Soviet tests may have exceeded the limit.

It should be obvious from all the technical factors discussed above, that it is impossible to state with 100% certainty that the Soviets have or have not violated the TTBT. Because of the statistical nature of the available data, we are forced to deal with probabilities and consistencies. The critical issue is whether the yields of the possible Soviet violations will give the Soviet Union a militarily significant advantage. I would not be

qualified to discuss the military significance of the alleged violations but based on my assessment of opinions in the nuclear weapons community, it does not appear to me that the yield range of possible Soviet violations would open up unique nuclear design opportunities.

Suggested Improvements in the TTBT Verification Regime

Since April 1, 1976, the U.S. and the USSR have agreed to observe the 150 kt limitation provided for in the Threshold Test Ban Treaty, pending ratification of that Treaty. However, since the treaty has not been ratified, the two parties have not carried out the exchange of geological and calibration data provided for in the Verification Protocol to the TTBT. These data include:

- identification of the test sites and testing areas therein,
- geological and geophysical properties of rocks in which tests are conducted,
- yield, date and location for two "calibration tests" in each geophysically distinct testing area.

In addition, the Protocol obligates the parties to give notification of every nuclear test after it has been conducted.

Similarly, the Peaceful Nuclear Explosion Treaty (PNET) provides for the exchange of the following information for every PNE carried out, regardless of its yield:

- purpose, location, planned date and yield at least 90 days before it is planned,
- description of the technical features of the project, including the type of rock and degree of saturation, and
- after the PNE has been fired, its exact time and actual yield.

For PNE's with yields greater than 100 kt the Protocol provides for on-site verification activities to confirm the geological data and, for groups of

PNE's with aggregate yields above 150 kt, for measurement of the yields by hydrodynamic means.

The PNET also provides for the establishment of a Joint Consultative Commission to handle the exchange of information and to resolve questions. It has generally been assumed that this JCC would also be the mechanism for the exchange of the TTBT data.

Since March 31, 1976, the Soviet Union has carried out over 50 PNEs scattered throughout the Soviet Union. However, none of the above information for these 50 some events has been made available because this Treaty also has not been ratified.

Thus, the U.S. finds itself in the situation that it is observing the 150 kt yield limit of the TTBT, but we can't reach a consensus whether the Soviets are or not. Some believe that the pattern of Soviet testing is consistent with observance of a yield limit; and when proper account is taken of the geological difference believed to exist at the Soviet test sites that this limit is 150 kt. Others reject this analysis, and seismology in general, and believe that the Soviets are systematically cheating by a factor as large as 2 or 3.

Failure to ratify these two Treaties has denied us a considerable body of data which was designed to improve our ability to estimate Soviet yields. Some have argued that the data to be exchanged would not significantly improve our ability to verify Soviet yields since there is no way to verify the accuracy of these data. There is some validity to this criticism and I would like to discuss it for a moment.

I think everyone would agree that it is impossible to believe the "calibration yields" that are to be exchanged. Without some means to verify those yields, they would be useless. I believe this is a major defect in the present treaty. The geological and geophysical data, however, could prove to be useful. Much is already known regarding the geology at the Soviet test site from a variety of sources, including published geological data, satellite reconnaissance, and even from seismic signals originating at the Soviet test

sites. I believe it would be very difficult for the Soviets to fabricate a geological framework that was false to a significant degree without it becoming apparent. Having said that, I would like to emphasize that it would still be highly desirable from both a technical and a political viewpoint to have an opportunity to confirm the geological and geophysical data.

Unfortunately, the major question regarding the differences in coupling and transmission of seismic waves from the Soviet test sites as compared to NTS, does not hinge on geological or geophysical properties that are readily measured, but rather on the existence of major differences in the upper-mantle, deep in the earth, under our respective test sites and on their ability to absorb seismic signals.

Thus, I believe the TTBT, as written, contains a number of critical, unverifiable provisions and falls short of providing the verification capability conceived of by those who negotiated it. The first step in enhancing the verifiability of the TTBT would be to consider measures that would rectify these defects.

The most straight-forward approach would be to verify the yields of the "calibration" explosions with on-site hydrodynamic yield measurements. The procedures spelled out in the PNET Protocol, with some minor modification, could well be satisfactory for carrying out these measurements. This could possibly be implemented by carrying out PNEs on the test site whose peaceful purpose is to serve as seismic calibration explosions. I believe procedures could be worked out for selecting the specific sites of the "calibration" explosions to reduce concerns that the locations were picked by the host to be particularly favorable to their interests. Observing the drilling and logging of the emplacement holes for these events, as provided for in the PNET, would serve to provide confirmation of the geological data exchange package in the vicinity of the calibration explosions.

Such an approach would not significantly reduce the random uncertainties associated with the estimates of yields at the Soviet test sites. But, perhaps more important, having <u>verified</u> yield data from the Soviet test sites

would determine the validity of the seismic methodology and thus resolve the present major disagreement regarding the existence of a systematic error or bias between the U.S. and Soviet test sites.

This first step would appear to me to be the minimum enhancement that must be taken to rectify the obvious inconsistencies of the TTBT as written. Further steps could be considered that would primarily have the effect of reducing the random errors associated with the yield estimates.

One approach would be the development of methods for use of other seismic waves which would be independent of the one seismic wave presently used. This approach would require no supplemental treaty provisions beyond those needed to implement the first step outlined above for monitoring a 150 kt threshold. It would require a continued program of seismic research focused on this issue to develop these new methodologies. Preliminary work indicates promise for significantly reducing the uncertainty of seismic yield estimates.

An alternative approach to significantly reduce the random uncertainties would be the on-site hydrodynamic yield measurement of all weapons tests above some yield such as 75 kt. These measurements would be similar to those provided for in the PNET except that for weapons tests, which typically have many diagnostic experiments in the emplacement hole, these measurements would be made in a satellite hole near the emplacement hole. This approach would require some restrictions on the experimental configuration of the canisters that contain the nuclear device and the diagnostic components to prevent degradation of the hydrodynamic yield accuracy. Care would have to be taken that these measures didn't impede nuclear test requirements or provide opportunities for revealing classified data.

The implementation of such enhanced verification regimes would significantly reduce the random uncertainties that are associated with yield estimates but no one should believe that they would eliminate concerns about systematic errors and the need to deal with questions of compliance in a statistical framework.

Conclusion

The question of whether to proceed with ratification of the TTBT and the PNET and with what verification regime is, at heart, a political judgment requiring the balancing of a number of issues.

The key issue is the extent to which possible Soviet evasion of the 150 kt threshold within the statistical uncertainties would threaten U.S. national security. Inherent in this judgment is the quantitative element of how uncertain our measurement system is which must be balanced against the qualitative judgment on what risk of detection of an evasion attempt the Soviet Union would be willing to accept.

The obvious value from a national security point-of-view of a very rigorous verification regime with minimum uncertainty must be balanced against the difficulties of negotiating such a regime or, failing negotiation, living with the present verification regime.

There are really four options available to the U.S. for action on the TTBT and the PNET. The first is to proceed with ratification of the two treaties as they presently stand. I believe such an action would have significant benefits in terms of the information to be exchanged and the procedures for technical dialogue that would be established. The risk from the viewpoint of Soviet cheating would appear no greater than those that exist at present which I believe are acceptable. I also believe that the uncertainties in seismic yield estimates, and hence concerns about Soviet cheating, can be significantly reduced through improved analysis techniques using multiple seismic waves.

The second option is to try to negotiate enhanced verification provisions. The possibilities range from verifying the geology and yield of the calibration explosion called for in the TTBT Protocol with on-site yield measurements to the administration proposal for verifying the yield of all explosions above some yield such as 75 kt. Any enhancement of our verification capability will reduce the risk of significant Soviet cheating. The key question is - how much is enough? If we are unsuccessful in getting

Soviet agreement to any enhanced verification provisions we are left with the remaining two options, neither of which, I believe, is in the U.S. interest.

The first of these two remaining options is to abrogate the treaty and resume high yield nuclear weapons testing. Unfortunately, the U.S. is limited to about 500-700 kt at the Nevada Test Site and testing above that level would require opening a new site. It is hard to be sanguine about such a prospect. The Soviet Union, the other hand, could promptly resume testing multimegaton yields at their Novaya Zemlya test site.

The last option would be to continue the status quo - to continue to observe the 150 kt treaty limit but forego the data exchange and other provisions of the two treaties. For those who perceive the present treaty as unverifiable or who believe that the Soviets are routinely violating the 150 kt limit, such an option would permit the Soviets to continue their practices of the last 10 years without any change.

So - what should the U.S. do? I believe the U.S. should, as a minimum, press for verification of the yields of the calibration explosions provided for in the TTBT Protocol. The arguments for this course of action are:

1. It would preserve and strengthen the very important principle that the U.S. believes verification of arms control treaties should be based on verifiable observables, not trust,

2. It is consistent with the Soviet view that verification provisions should be proportional to the nature and scope of arms control agreement being dealt with,

3. It would provide data for validation of the seismic methodology and thereby resolve the most egregious disagreements within the community regarding Soviet yields and Soviet compliance,

4. It would provide an opportunity for the two countries to begin gaining experience with the conduct of on-site verification activities, thereby building a base on which other treaties that the U.S. believes will require on-site verification can be built, and

5. It would present no risk to U.S. national security beyond that which is already being accepted or would be accepted without ratification.

In summary, I would urge that the Senate provide the President with a wide range of options for enhanced verification so that any future opportunities for progress with the Soviet Union on the TTBT can be fully considered as a basis for proceeding with ratification.

Senator EXON. Thank you very much.

We will hold our questions, as I have indicated, until we hear from the other panel members.

The next witness that we have is Paul Richards.

Dr. Richards.

STATEMENT OF PAUL G. RICHARDS, DEPARTMENT OF GEOLOGICAL SCIENCES, COLUMBIA UNIVERSITY AND LAMONT-DOHERTY GEOLOGICAL OBSERVATORY

Dr. RICHARDS. Thank you, Mr. Chairman. I have taught seismology at Columbia University for a number of years, and perhaps the main contribution that I can make today is to review what is meant by uncertainty in yield estimation. I think there appears to be some confusion about the very concept.

Thus, my written testimony, on pages 2 through 5, begins with a basic tutorial which tries to explain some of the language and some of the concepts which lie at the heart of the technical debate, the debate on whether we have effective verification for these treaties.

I should appreciate that written testimony being a part of the record.

Senator EXON. It will be made part of the record.

Dr. RICHARDS. Thank you.

I would then choose to go on to comment on how these purely technical and noncontroversial issues have recently been presented to the Congress. I conclude with some remarks about seismic methods and how accurate they are.

So, starting just briefly with some of the tutorial material—and since you have it, it can be looked at on page 2—the ideal method for estimating yield of a particular explosion would, of course, be one that just gave a single number. But all methods, unfortunately, in practice are somewhat uncertain.

So the ideal of having a method out there which will give you one single number for the yield of a nuclear explosion unfortunately is unattainable.

So the device that scientists use in this situation is a kind of bell-shaped curve, a kind of histogram that conveys not just a single yield but a sense of which yield values are most likely to be right.

This idea is the basis for developing precise statements about the uncertainty of a particular yield estimate because the curve, as a whole, has some very informative uses.

Thus, if we pick any range of yields, then there is a property of the curve which allows us to give the probability that the actual yield lies in that range.

This probability turns out to be the area under the curve over that yield range.

Now, clearly, the shape of the histogram is important in that it determines whether a yield estimate is accurate or not.

Fortunately, for a single explosion of interest, for which we are trying to come up with a yield estimate and its uncertainty, the shape of the relevant bell-shaped curve can be completely specified by just two numbers. The first is the so-called central value yield, which, essentially, is the single most likely value. The second

number, called the factor of uncertainty, gives the range of yields that is covered by 95 percent of the total area under the curve.

For example, if we said of a particular explosion that its central value yield is 120 kilotons with a factor of uncertainty equal to two, we simply mean that there is a 95 percent chance that the actual yield lies somewhere in the range from 60 to 240.

Of course, there is a greater chance that the actual yield lies near the middle of the range than nearer the ends.

For example, another way to present this explosion is to say that there is a 50 percent chance of the actual yield laying in the range of from 96 to 150. I have given several more examples of these ideas in my written testimony. They show the importance of working with a yield estimation method that has a lower factor of uncertainty. Perfect would be a value of one. But this cannot be attained.

The CORRTEX method, as proposed for use in the Soviet Union, to improve TTBT verification, is claimed to have a factor of uncertainty of about 1.3. It is widely reported that the seismic method has a factor of uncertainty equal to two.

I wish to comment, first, on how this seismic capability has recently been reported to the Congress, and, later, on the question of whether a factor of two is, indeed, an accurate summary of yield estimation uncertainty by seismic methods.

Thus, Dr. Barker this morning gave us the following description. These are his words: "This uncertainty factor, a factor of two, means, for example, that a Soviet test, for which we estimate by the seismic method a yield of 150 kilotons, may have, with 95 percent probability, an actual yield as high as 300 kilotons, twice the legal limit, or as low as 75 kilotons."

In my view, the problem of such a characterization by Dr. Barker is the false impression it tends to convey that seismic yields have a high chance of being badly wrong.

The fallacy stems from taking a large yield range, so that, indeed, there is a good chance of bracketing the actual yield, and then wrongly inferring that the extremes of this range are representative of what the actual yield could be.

Returning to the question of whether a yield estimate reported as 150 kilotons, central value, could actually be above 300 kilotons, the answer can be given graphically, as shown on page 7 of my written testimony. For those of you who have it on page 7, there is a graphic up there. I draw here your attention to a very small part of the area under that curve as being shaded. That turns out to be a 2.5 percent probability that a yield reported as 150 kilotons would actually be above 300. In other words, it is a very low probability.

I know that Dr. Siegfried Hecker this morning, the Director of Los Alamos, has recently testified that the opportunity to test at 300 to 450 kilotons cannot be denied to the Soviets. He is apparently saying that the Soviets could test at yields two or even three times above the allowed threshold without our knowledge.

I find this hard to take, of course, since it seems to me this amounts to a dismissal of my profession as a seismologist. I just would simply suggest that Dr. Hecker be required to give the technical basis for his conclusions in an appropriate forum.

Moving on to the question of what really is the accuracy of seismic methods, a natural place to begin is to inquire what is the accuracy in application to our own explosions in Nevada.

There are open studies of that question, and it appears to me that the factor of uncertainty can be pushed down even to around 1.3.

Now, some of my professional colleagues will argue with me here, and I am not offering this number, a factor of uncertainty of 1.3, by the seismic method for our own explosions as one that represents a consensus in the technical community. However, I do believe there is a consensus that the factor of uncertainty for the best seismic methods, taken as a whole, is well below two for estimation of NTS yields.

Concerning yield estimation for the Soviet nuclear tests, I would again claim that a value of two for the factor of uncertainty is not a fair summary of current capabilities, because it refers only to one type of seismic method, and for large explosions there are typically three or more independent seismic waves upon which separate seismic yield estimates can be based.

If the average of these estimates is taken as the central value yield, with a factor of uncertainty of two, at the 95 percent level for each of these three methods, it is easy to show that the resulting seismic yield estimate has only a factor of 1.5 uncertainty.

Now, there may be a debate as to whether the available seismic methods are each equally good and how they should be weighed in coming up with the best estimates overall.

My point is, simply, that for large explosions which generate a variety of different seismic waves, the factor of uncertainty that you get by combining different seismic methods is less than two.

I will say, too, that the debate on this question is not purely a technical one because, in order to build a technical case for a particular value of the factor of uncertainty, there has to be a review of what information can be folded into the process.

For example, the question of whether any Soviet supplied data can be used cannot be decided purely by the technical community.

I conclude by commenting that the problem of assessing compliance with the yield threshold will always have difficulty in situations where testing by either side is taken right up to the threshold.

The technical uncertainty here is not unique to seismology nor to 150 kilotons. If a method that was really excellent, that had, say, a 1.1 factor of uncertainty, and testing was routinely taken up to the threshold but not above, then there would still be a nearly 50–50 probability that the central value estimate would exceed that threshold for the largest events.

[The prepared statement of Dr. Richards follows:]

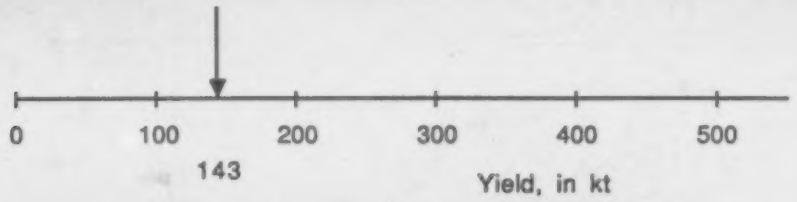
Testimony of Paul G. Richards, Professor of Geological Sciences, Columbia University

Mr. Chairman, members of the Committee, I was asked last Monday evening to testify to you on technical issues in seismology, with reference to monitoring explosions and specifically in connection with the Threshold Test Ban Treaty (TTBT). I have taught seismology at Columbia University for 15 years. For twenty years I have been familiar with research programs related to seismic monitoring of explosions. In 1984 I began a 12-month appointment as a Visiting Scholar (a William C. Foster Fellow) with the U.S. Arms Control and Disarmament Agency. I am currently a member of the Advisory Panel recently set up to oversee an Office of Technology Assessment study, entitled "Seismic Verification of Nuclear Test Limitation Treaties.

The first part of my testimony is a tutorial on what is meant by "uncertainty" in yield estimation. I then comment on how this issue has recently been presented to the Congress. I conclude with some remarks about the accuracy of seismic methods of yield estimation, and an acknowledgement that the assessment of Soviet compliance with the TTBT is not a purely technical issue.

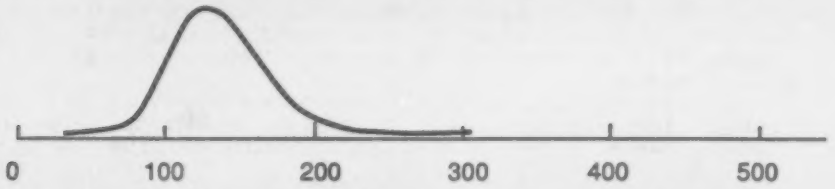
Tutorial

Ideally, the technical community would like to assign yield (for a particular explosion) as a single unambiguous value. This would amount to picking a particular point as in the diagram below. Thus, we'd like to accumulate evidence that specifically points to one value of yield, for example 143 kt.

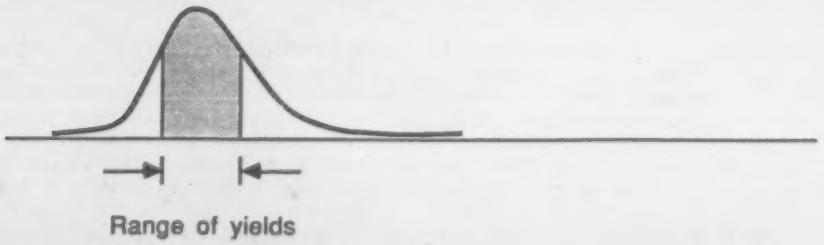


But this is never possible. Whatever technical method is used to measure yield, there is always some uncertainty. This is true for radiochemical, seismic, and CORRTEX methods.

The method used to characterize the uncertainty is to think of a yield estimate not as an arrow pointing to one particular value, but as a kind of histogram that indicates which yields are probable and which are improbable. The diagram for conveying this uncertainty looks as follows:



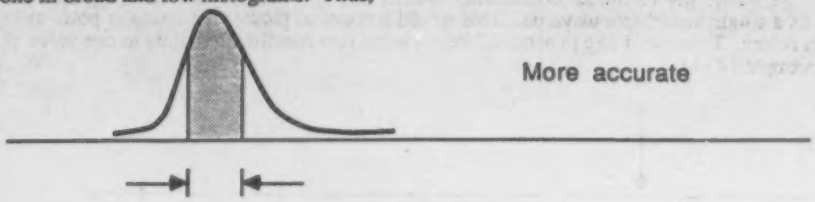
For yield values where the curve is high, one has a greater chance of finding the actual, correct yield. This idea is the basis for developing precise statements about the uncertainty of a particular yield estimate, because the curve as a whole has some very informative uses. Thus if we pick any range of yields, then there is a property of the curve that allows us to give the probability that the actual yield lies within that range. This probability turns out to be the area under the curve, over that yield range.

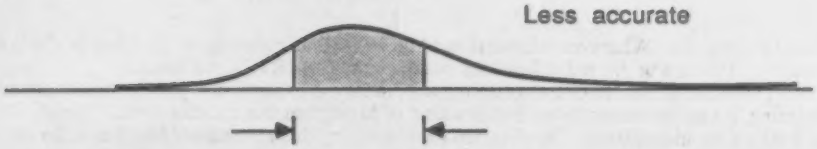


The shaded area, expressed as a percentage of the total area under the whole curve, is the probability that the actual yield truly does lie within the range of yields we have chosen. This is the main idea, and once it is grasped one has a method of examining any yield range of interest, and then stating the probability that the actual yield lies within that range.

Clearly, the shape of the "histogram" is important in that it determines whether a yield estimate is accurate or not. (The desired standard of accuracy is set from requirements external to the particular method used for yield estimation.)

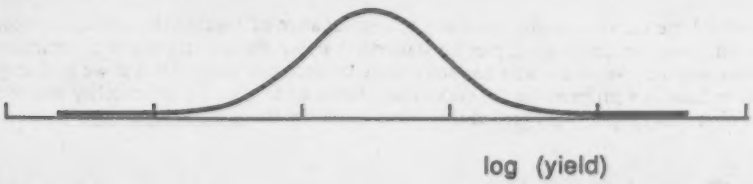
A good method of yield estimation will result in sharply peaked histograms, a poor one in broad and low histograms. Thus,



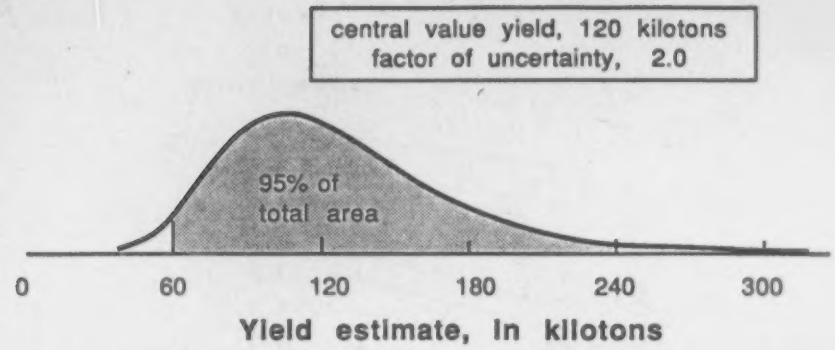


in the first example (above) even a narrow range of yields can achieve high probability of capturing the actual yield, because most of the area under the curve is concentrated over a narrow range. In the second example, a relatively wide range of yield values must be taken in order to include the actual yield with high probability.

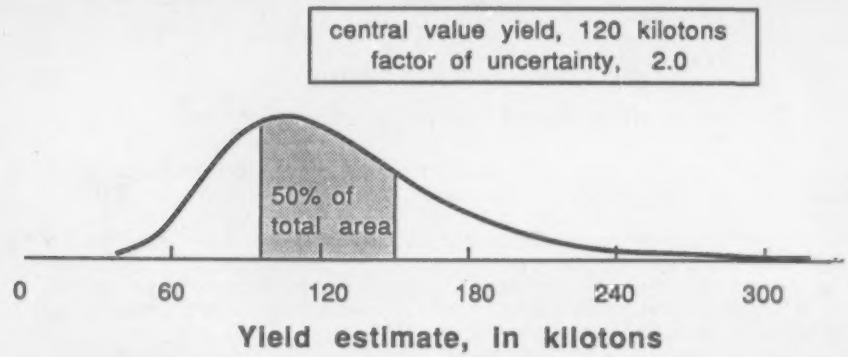
Fortunately, the overall shape of these curves is quite well understood, using ideas that go back to the 1800's. For various seismic methods, these curves are known as "gaussian" or "normal" or "bell shaped" if one chooses to plot them not against yield but against the logarithm of the yield.



It follows that they become slightly unsymmetrical if we plot them actually against yield, as shown in the earlier examples. Fortunately, however we choose to plot them, a particular curve can be specified by only two numbers. One, is the so-called "central value yield." This is the yield value where the curve is highest [more precisely, where it is highest when the curve is plotted, as just given above, against log (yield)]. The other important number is a measure of how wide the curve is, and thus of the uncertainty to be associated with the central value. There are several different though wholly equivalent ways to give this number, but fortunately there is now an accepted convention in the application to yield estimation. The second number is called the "factor of uncertainty," and by convention it gives the range of yields (about the "central value") that is covered by 95% of the area under the curve. This range extends from the central value yield divided by the "factor of uncertainty," up to the central value multiplied by the "factor of uncertainty." For example, if we say of a particular explosion that its central value yield is 120 kt with a factor of uncertainty equal to 2, we mean that there is a 95% chance that the actual yield lies somewhere in the range 60 kt to 240 kt. The presentation is as follows:

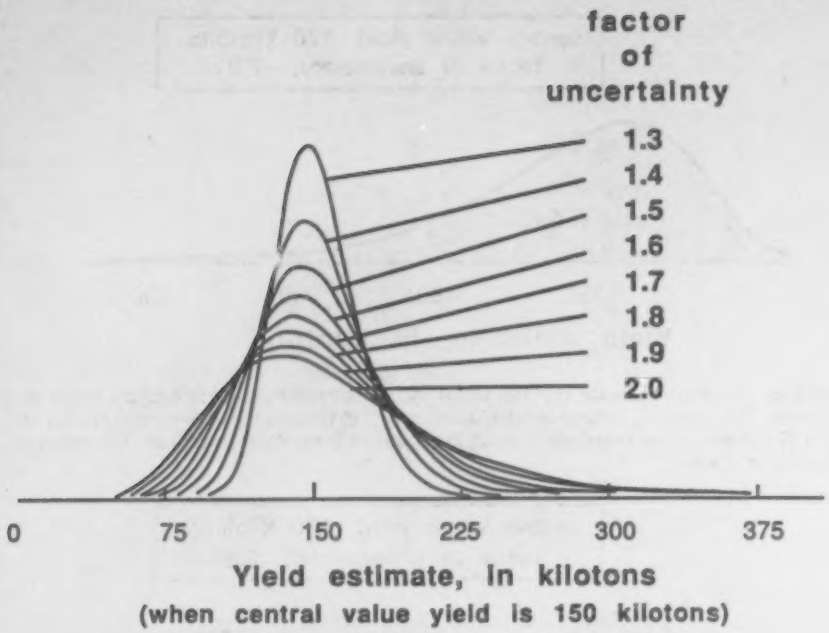


Of course, there is a greater chance that the actual yield lies nearer the middle of the range than nearer the ends. For example, it turns out that another way to present the above results is say that there is a 50% chance of the actual yield lying in the range from 96 kt to 150 kt. The graphical presentation looks like this:



In other words, there is a trade-off between whether we want to give a larger range of yields that has a high probability (95%) of capturing the right value (the actual value), or whether we want to give a smaller range and accept a lower probability (50%). The "histogram" can be used to give the answer in either case.

We can now give some master curves that underlie much of the current debate concerning verifiability of the Threshold Test Ban Treaty (TTBT):



These curves show the sense in which probability is more concentrated about the central value (150 kt), as the factor of uncertainty is reduced from 2.0 to 1.3.

From the above material, one can see the importance of working with a yield estimation method that has a lower "factor of uncertainty." For reference, note that the CORRTEX method, as proposed for application by the U.S. to nuclear explosions at Soviet test sites, is characterized by a factor of uncertainty equal to 1.3 (this may be inferred from statements in U.S. Department of State Special Publication 150, August 1986).

Comments on reportage to the Congress

It is widely reported that the seismic method has a factor of uncertainty equal to 2 (often stated simply as a "factor of 2"). I wish to comment, first, on how this seismic capability has recently been reported to the Congress, and later on the question of whether a "factor of 2" is indeed an accurate summary of yield estimation uncertainty by seismic methods.

Thus, on January 13, 1987, Dr. Robert Barker (the Assistant Secretary of Defense for Atomic Energy, and leader of a U.S. delegation at bilateral talks on improving verification of the Threshold Test Ban Treaty) testified before the Senate Committee on Foreign Relations. Referring to the widely assumed "factor of 2" that is often said to characterize uncertainties of yield estimation in seismology, Dr. Barker gave the following description:

> "...this uncertainty factor means, for example, that a Soviet test for which we estimate [by the seismic method] a yield of 150 kt may have, with 95% probability, an actual yield as high as 300 kt - twice the legal limit - or as low as 75 kt."

The problem of such a characterization is the false impression it conveys, that seismic yields have a high chance of being badly wrong. Dr. Barker could have continued in the same vein with a conclusion that the same explosion may have, with 99% probability, an actual yield as high as 420 kt - or as low as 53 kt! Had the uncertainty factor been 1.3, his argument also would translate to saying that

> .....a Soviet test for which we estimate [by, for example, the CORRTEX method] a yield of 150 kt may have, with more than 99% probability, an actual yield as high as 300 kt - or as low as 75 kt ...

and thus falsely leave the impression that the CORRTEX method is even more inaccurate than other methods, since it here appears even more likely (than, for example, seismology) to fail to identify a high actual yield.

The fallacy in these conclusions stems from taking a large yield range (so that indeed there is a good chance of bracketing the actual yield) and then wrongly inferring that the extremes of this range are representative of what the actual yield could be. It's like saying that

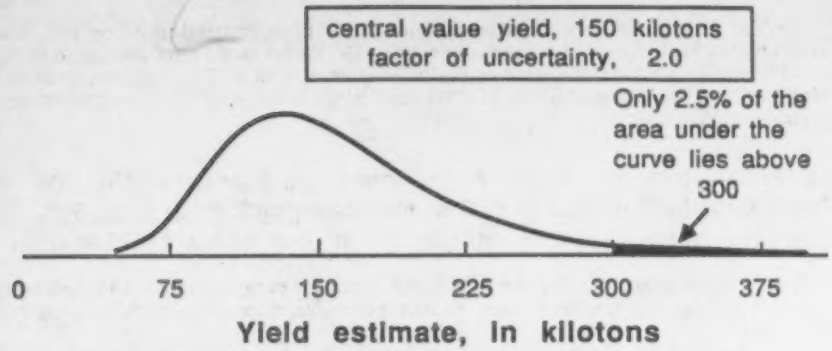
> .....a 'man in the street' may be, with high probability, actually a billionaire, or he may be very poor ....

In a sense this statement is strictly true, because of a meaning of the word "may." But it is not a useful statement, and it is certainly not the way to characterize such information about the 'man in the street' as we may have.

An interagency study titled "Possible avenues for cooperation with the Soviet Union in the deveopment of capabilities for verifying compliance with nuclear testing limitations", in a report issued on July 14, 1986 (see House Document 99-258), had a description of seismic capabilities as follows:

> "While we judge that, at present, there is approximately a factor of two uncertainty in the yield estimates derived by seismic methods, there are reasons to suggest the uncertainty could be actually smaller (or conceivably larger). A factor of two uncertainty means, for example, that a Soviet test for which we derive a "central yield" value of 150 kt may have, with a 95 percent probability, a yield as high as 300 kt or as low as 75 kt."

Dr. Barker's statement before the Committee is essentially a repeat of part of the interagency report, though he did not take the opportunity to indicate the expert technical community in general would characterize seismic yield estimates as having less than a factor of two uncertainty. I would suggest that the report, generated by (presumabably) the key agencies working on nuclear testing policy, indicates that there is a poor understanding of the central issue of what is meant by uncertainty in measurement of explosion yields. Thus, on the question of whether a yield estimate reported as 150 kt (central value) could actually be above 300 kt, the answer can be given graphically as follows (again, assuming a factor two uncertainty):



The probability is only two and a half percent (one chance in forty).

On January 15 1987, Dr. Siegfried Hecker (the Director of Los Alamos National Laboratory) testified before the Committee on Foreign Relations. Referring to the accuracy of current methods of yield estimation he said statistical studies at his Laboratory have reached the conclusion that

> "the opportunity to test at 300 to 450 kt cannot be denied to the Soviets."

His written testimony noted:

> "a violation at the 300 to 450 kt level can no longer be dismissed as having little significance.....The ability to conduct such tests cannot be denied the Soviets under the present treaty provisions, even after the exchange of data that will follow ratification [of the Threshold Test Ban Treaty]. On the other hand, the U.S. has scrupulously complied with the 150 kt limit. Since both sides have strategic weapons requirements well in excess of this limit, violation of the limit by the Soviets could create an asymmetry that has significant military implications."

With his assertion that the Soviets could test at yields two or even three times above the allowed threshold without U.S. discovery, Dr. Hecker is apparently saying that seismic methods of yield estimation (and other National Technical Means) are fundamentally incapable. Of course, he has a perfect right to hold this opinion, and it is difficult for me as a seismologist to debate the issue since it does not appear to be a debate within my profession on technical matters. Rather, it appears to be a dismissal of my profession as a whole. But there is the question of accountability, and for someone in Dr. Hecker's position it is surely necessary that he explain why at this time he holds an opinion so different from that of others who have studied these issues extensively. His statements in this area are clearly true, if they mean that current methods are not perfect. But we know that future methods will not be perfect either. Discussion of yield estimation has substance, at this stage of exploring what is meant by "effective verification" and "improved verification", only if it is developed in terms that reflect the reality that no method is perfect.

Comments on the accuracy of seismic methods

Moving on to the question of what really is the accuracy of seismic methods, a natural place to begin is to inquire what is the accuracy in application to our own nuclear explosions at the Nevada Test Site (NTS). There are open studies of this question, and from what appears to be one of the best methods (the use of the seismic wave known as "Lg") it appear that the factor of uncertainty can be pushed down to around 1.3. Some of my professional colleagues will argue with me here, and I am not offering this number (1.3) as one that represents a consensus within the technical community. However, I do believe there is clearly a consensus that the factor of uncertainty (for the best seismic methods, taken as a whole) is well below 2, for estimation of NTS yields above 10 kt (in hard rock, below the water table). I am prepared to give a technical defense of my claim that the factor is as low as 1.3.

Concerning yield estimation for the Soviet nuclear tests of concern with respect to the TTBT, I would again claim that a value of 2 for the factor of uncertainty is not a fair summary of current capabilities, because it refers only to one type of seismic method, and for large explosions there are typically three or more independent seismic waves upon which separate seismic yield estimates can be based. If the average of these estimates is taken as the central value yield, with a factor of uncertainty of 2 (at the 95% level) for each of three methods, it is easy to show that the resulting seismic yield estimate has only a factor of 1.5 uncertainty. There may be debate as to whether the available seismic methods are each equally good, and how they should be weighted in coming up with a best estimate using more than one seismic method. (For example, I do not believe the Lg method is yet as good, for Soviet explosions, as it is for events at NTS.) My point is simply that for large explosions, which generate a variety of different seismic waves, the factor of uncertainty achieved by combining various seismic methods is less than two. The debate on this question turns out not to be a purely technical one, because in order to build the technical case (for a particular value for the factor of uncertainty) there has to be a review of what information can be folded in to the process. For example, the question of whether any Soviet-supplied data can be used, cannot be decided purely by the technical community.

On the question of Soviet compliance with the Threshold Test Ban Treaty, I recognize that this has to be decided as a political judgement. The way that the technical community can contribute, is to give a best professional opinion on the relevant numbers. For example, we can come up with best estimates for the yield of Soviet explosions, and we have to describe our uncertainty associated with these estimates.

The biggest Soviet explosions in recent years have been in Eastern Kazakh, near the town of Semipalatinsk. There have been many open-literature studies of these events, and typically these papers do show some with yield estimates above 150. But there's a couple of ways to see that this is not the end of the story. For example, consider a program of testing at 149 kt every year. Then, because each seismic estimate is not going to be absolutely accurate, some seismic estimates will come in above 150. In fact, this would be expected to happen, if the Soviets were repeatedly testing right up to the allowed threshold. Another way to appreciate that a few events with seismic yields above 150 does not directly indicate non-compliance, is to consider what would happen if the seismic method were applied to our own test site in Nevada. [This basic idea is described in a Congressional Research Service document, No. 86 - 155 SPR "MONITORING NUCLEAR TEST BANS" by David W. Cheney]. Because of the uncertainties, some of the U.S. weapons tests would be estimated, from seismic measurements, to be over 150 kilotons.

I conclude by commenting that the problem of assessing compliance with a yield threshold will always have difficulty because of technical uncertainties. The technical uncertainty is not unique to seismology, nor to 150 kilotons. If a method that had a 1.1 factor of uncertainty were used, and testing was routinely taken up to the threshold but not above, then there would still be a nearly 50-50 probability that the "central value" estimate would exceed that threshold for the largest events.

Senator EXON. Thank you very much.

We appreciate those interesting comments. When I looked at the graph, I think I basically had a comprehension of what you are trying to get across.

We will proceed now to the last witness on this panel, Frank von Hippel.

Dr. von Hippel, welcome. Please proceed.

STATEMENT OF FRANK VON HIPPEL, CHAIRMAN, FEDERATION OF AMERICAN SCIENTISTS FUND, PRINCETON UNIVERSITY

Dr. VON HIPPEL. Thank you, Mr. Chairman.

I have been asked to look beyond the 150 kiloton Threshold Test Ban Treaty to further constraints on nuclear weapons tests that might be considered in follow-on test ban agreements.

As Dr. Richards and Mr. Nordyke are specialists on the verifiability of such agreements, I will focus on the other issues that arise.

I will discuss each of the major purposes of testing and how they would be affected by a lower threshold or testing quotas.

THE PURPOSES OF TESTING

The purposes of nuclear testing, as has been discussed this morning, are four.

One is the development of new weapons.

Two is the understanding of nuclear weapons effects.

Three is testing of design improvements relating to safety or safeguards against unauthorized use.

Four is fixing problems in already developed weapons, or so-called reliability tests.

DEVELOPING NEW WEAPONS

The primary purpose of most nuclear weapons tests today is the development of new nuclear weapons. The principal underlying disagreement that divides the advocates and opponents of test bans is the political issue of whether, on balance, new nuclear weapons will make us safer, or not.

On the one hand, opponents of continued testing see the danger of nuclear war as being fed by mutual fears of first strikes—fears that could become self-fulfilling in a crisis. They see most of the new nuclear weapons under development as feeding such destabilizing fears of first strikes.

On the other hand, advocates of continued testing see Soviet expansionism as being the principal source of the danger of nuclear war. They believe that maintaining the credibility of U.S. threats of first use of nuclear weapons is critical to keeping the Soviet Union in check.

My own view is that once a country obtains for itself even one-tenth of the huge levels of survivable destructive power that the United States and the Soviet Union each currently possesses, it has bought for itself most of the deterrence that nuclear weapons can provide. Beyond this point, trying to give the nuclear threat more credibility is like the man who has filled up his house with dynamite, continually inventing new triggering mechanisms to convince

potential burglars that the house really will blow up if they break in.

Other people have different views.

Choosing between these positions, however, depends primarily on our individual perceptions of the lessons of history and on psychology, not on technical issues.

Once you have made up your mind on the desirability of developing new nuclear weapons, you can then turn to a technical discussion of the other three purposes of nuclear weapons testing for some quantitative guidance concerning the choices of potential thresholds and quotas.

NUCLEAR SAFETY EFFECTS

One of these technical issues relates to the need for continued nuclear testing to understand the effects of nuclear explosions on nearby weapons or communications links.

Here, once you are restricted to underground testing, as we are by the 1963 Limited Test Ban Treaty, drastic reductions in yield limits would not significantly impede nuclear effects tests. For example, about the same radiation intensities can be achieved 40 meters from a one-kiloton test as 500 meters from a 150-kiloton test.

For this reason, and because tests involving smaller yield explosions are less expensive, most U.S. nuclear weapons effects tests are already conducted at quite low yields—I think typically about one kiloton.

SAFETY AND SECURITY

Another technical reason that is given for continued testing is the need for design improvements in the areas of safety and protection against unauthorized use.

The safety of U.S. nuclear weapons is already quite good, however. Specifically, they are designed to be virtually immune from accidental nuclear explosion, even if a segment of the chemical explosive in the nuclear trigger is detonated by, for example, the penetration of a bullet or as a result of its being immersed in a fire.

For this reason, current work on safety improvements is focused on the much less serious problem of reducing the dispersal of toxic plutonium if the chemical high explosives in a nuclear weapon should detonate or burn. An important advance in this regard has been the use in new nuclear weapons of insensitive high explosives, that are much less subject to accidental explosions.

Retrofitting the remaining nuclear weapons with insensitive high explosives would require some nuclear tests. But the process of substitution is well advanced and could probably be brought to completion relatively quickly, if desired.

Virtually all other safety improvements are in the mechanical and electrical design of the triggering systems and can be adequately tested without a significant nuclear explosion.

This can be done by removing the chain reacting nuclear material from the explosive and replacing it with a nonchain reacting material such as depleted uranium and then triggering the chemical explosion; or it can be done by only partially removing the

chain reacting material, leaving only enough so that a very small nuclear explosion results.

The production of the neutrons from such a so-called "zero-yield" nuclear test provides an extremely sensitive measure of the degree of compression that has been achieved by the chemical implosion—which is the key question in a safety test of a nuclear explosive.

Such zero-yield nuclear tests would not be barred by the lowering of the test ban threshold to one kiloton or even below.

Virtually all significant improvements in the permissive action links and self-disabling features protecting U.S. nuclear weapons from unauthorized use also involve changes in their electrical and mechanical design that could be adequately checked out with non-nuclear or zero yield nuclear tests.

RELIABILITY

This leaves the final purpose for nuclear weapons tests—the one that apparently played a key role in derailing President Carter's effort to achieve a comprehensive test ban. These are tests of fixes of problems that are detected in already deployed nuclear weapons. This problem of the need for reliability tests was discussed at length this morning.

The first point that should be made here is that reliability tests are not random tests of weapons already in the stockpile. Prohibitive numbers of tests would be required to maintain confidence in the stockpile in this manner.

The principal way in which problems are detected and rectified is by disassembly and by inspection and by nonnuclear tests.

The weapons labs have recently stated, in order to buttress the argument that we do need reliability tests, that one-third—that is, 14 out of 41—of all weapons designs introduced into the stockpile since 1958 have encountered reliability problems, of which 75 percent were discovered and/or corrected as a result of nuclear testing.

Thus far, information on 8 of these 14 cases has been made available for review by Dr. Ray Kidder, an experienced weapons designer, at the Livermore Lab, who has demonstrated a willingness to take an independent stand on such questions.

Dr. Kidder has concluded that none of the eight cases that he was able to review can be used to support the argument that nuclear testing is required to deal with reliability problems in fully tested and deployed designs.

He found, for example, that one-half of the cases that he was shown involved weapons which were placed in the stockpile before completing a full program of certification tests because of the 1958–61 testing moratorium.

Based on Dr. Kidder's review, it appears that the weapons labs have overstated the need for reliability testing. However, it is impossible for an outside observer, like myself, to judge whether the labs' claims are completely without merit. As far as I know, there may be some legitimate need for reliability testing.

THE NEXT STEP

Significant further limitations on nuclear weapons tests could be agreed to, however, even while we await the final clarification of this issue. This is because only a few percent of all nuclear tests are reliability tests, and these reliability tests could be conducted below a threshold set at about 10 kilotons.

With regard to the frequency of reliability tests, the Department of Defense has informed this committee that during the period 1970 to 1985, only eight tests—an average of one every 2 years—were justified primarily by the need to test the remedy of a defect in an already deployed nuclear weapon.

This should be compared with the average of approximately 20 nuclear tests per year, which were conducted during this period for all purposes.

A quota of less than one test per year could, therefore, deal with the concerns that have been raised about the need for reliability tests.

With regard to the yields required, concerns about reliability appear to focus almost exclusively on the finely-tuned so-called "boosted" fission primary explosives that are used to ignite thermonuclear reactions in the second more powerful stage of modern strategic nuclear warheads. The yields of most U.S. primaries fall in the range of 5 to 15 kilotons, and the consensus of weapons experts is that reliability testing can be done at less than full yield.

A lowering of the testing threshold to about 10 kilotons would, therefore, not significantly impair our ability to test fixes to problems with the primaries.

Based on these considerations, it appears that there are two steps required to achieve a consensus position on further limits of nuclear testing.

First, it is necessary to achieve political consensus that the world would be a safer place if we didn't have the U.S. and Soviet nuclear weapons labs continually promoting what they claim are more usable nuclear weapons.

I think that after more than a decade of discussions on the controllability and consequences of so-called "limited" nuclear wars, we may be within sight of such a consensus.

Second, we must achieve a broader understanding that testing for purposes of determining nuclear weapons effects and for testing safety and security can be done below a very low threshold, perhaps of one kiloton, and that any required reliability testing can be carried out within a quota of about one test a year at a yield of less than 10 kilotons.

CORRTEX

Finally, I would like to return to the question of immediate concern to this committee and the Senate, the ratification of the 150 kiloton threshold test ban and the administration's reservations regarding additional verification requirements, specifically the on-site CORRTEX method.

Two weeks ago, as you mentioned, Mr. Chairman, I participated in an international workshop on the verification of threshold test bans, which was held in Moscow. U.S. experts from Los Alamos

were originally supposed to attend and answer questions about the administration's position on CORRTEX. But, at the last minute, the administration stopped them from coming.

The workshop was therefore of interest principally because it provided us a first opportunity to hear a Soviet critique of the CORRTEX technique.

Basically, the position presented by the Soviet experts was that, while CORRTEX can be a relatively reliable means for a country to monitor its own tests, it would not be reliable in an adversarial situation. The Soviet scientists described various uncertainties and potential evasion methods which they felt could result in uncertainty factors for the yield estimates from CORRTEX as large as two to three—far larger than the uncertainty range of 1.3 to 1.5 that Dr. Richards quoted for seismic yield estimates.

The Soviet CORRTEX experts acknowledged that the various uncertainties and evasion possibilities that they raised could be dealt with by detailed inspections of the geology and testing arrangements. But they felt that these inspections would have to include an inspection of the interior of the large canisters that contain the nuclear explosive and the associated diagnostic equipment used in nuclear weapons tests. They felt that such inspections would be unacceptably intrusive for the weapons labs.

Pending the translation of the Soviet paper, I can say little about its quantitative conclusions. Qualitatively, however, they are consistent with those that were arrived at by Professor Frederick Lamb in a review of the CORRTEX technique done for the Senate Foreign Relations Committee. Similar concerns about the potential intrusiveness of the inspections required to insure the accuracy of CORRTEX measurements have also been expressed by the U.S. weapons labs.

I, therefore, fear that U.S. insistence on CORRTEX measurements for weapons tests would block progress on the 150 kiloton threshold test ban.

However, the possibility that has been discussed by Dr. Batzel and Mr. Nordyke of doing CORRTEX measurements on the two calibration shots required by the threshold test ban Treaty might well be acceptable to the weapons labs on both sides.

Of course, if we go on to a lower threshold test ban, the CORRTEX technique becomes irrevelant since it does not seem to be applicable at all below about 50 kilotons.

Thank you.

[The prepared statement of Dr. von Hippel follows:]

PREPARED STATEMENT OF DR. FRANK VON HIPPEL,[1] PRINCETON UNIVERSITY

AFTER THE 150-KT THRESHOLD TEST BAN

I have been asked to look beyond the 150-kiloton Threshold Test Ban Treaty (TTBT) to further constraints on the yields and/or frequencies of nuclear weapons tests that might be considered in follow-on test-ban agreements.

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[1] Frank von Hippel, a theoretical physicist, is Professor of Public and International Affairs at Princeton University. For the past several years, his research has focused on nuclear weapons policy. This research is currently being carried out under Princeton University's Finite Deterrence Project, the purpose of which is to help develop the analytical basis for ten-fold (90 percent) reductions in the U.S. and Soviet nuclear weapons arsenals. von Hippel is currently also

Continued

As Dr. Richards and Mr. Nordyke are specialists on the verifiability of possible future agreements with lower thresholds, I will focus on the other issues that arise. My understanding of these questions is based entirely on information that has been made public by the U.S. nuclear weapons establishment combined with the insights that I have been able to derive from the "back-of-the-envelope" calculations that are a principal tool of theoretical physicists. My conclusions, however, appear to be consistent with those of experts who have had full access to classified information but are unable, because of this access, to speak as freely in public as I can.

MORE STRINGENT LIMITATIONS AND THE PURPOSES OF NUCLEAR TESTING

The main body of my testimony is organized as a brief discussion of each of the major purposes of testing and how they would be affected by a lower threshold or testing quotas. These purposes are the following:

1. The development of new nuclear weapons;
2. The understanding of nuclear weapons effects;
3. Testing of design improvements relating to safety or safeguards against unauthorized use; and
4. Fixing problems in already-development weapons—the so-called "reliability tests."

Development of New Nuclear Weapons.—Although many technical issues have been raised in the debate over nuclear test bans, the principal underlying disagreement that divides the advocates of and opponents of test bans is political not technical. The issue is whether, on balance, new nuclear weapons will make us safer or not:

Opponents of continued testing see the principal danger of nuclear war as originating from mutual fears of first strikes which could become self-fulfilling in a crisis. And they see most of the new nuclear weapons under development as feeding such destabilizing fears of first strikes.

Advocates of continued testing see the principal danger of nuclear war as being Soviet expansionism. They believe that maintaining the credibility of U.S. threats of first use of nuclear weapons is critical to keeping the Soviet Union in check.

Obviously, there is some truth to each of these concerns and one's position on test bans depends upon how you balance them.

My own view is that, once a country obtains for itself even one tenth of the huge levels of survivable destructive power that the United States and Soviet Union each currently possess, it has bought for itself most of the deterrence that nuclear weapons can provide. Beyond this point, trying to give the nuclear threat more credibility is like a man who has filled up his house with dynamite continually inventing new triggering mechanisms to convince potential burglars that the house really will blow up if they break in.

Other people have different views. I think that most agree that you cannot fight to win a nuclear war but many nuclear-weapons-policy makers believe that we can squeeze more deterrence out of acting as if we believe that we can, in fact, fight a nuclear war. Choosing between these positions depends primarily upon our individual perceptions of the lessons of history and of psychology.

Although deciding on the desirability of the development of new nuclear weapons depends primarily on political judgments, a technical discussion of the other three purposes of nuclear weapons testing does provide some quantitative guidance concerning the choice of thresholds and quotas.

Understanding Nuclear Weapons Effects.—The first of these nonpolitical reasons that is given for continued nuclear testing is the need to understand the effects of nuclear explosions on nearby weapons or communication links.

Once you are restricted to underground testing, however—as we are by the 1963 Limited Test Ban Treaty, drastic reductions of yield limits would not significantly impede nuclear effects tests. For example, about the same radiation intensities can be achieved 40 meters from a one-kiloton test as 500 meters from a 150-kiloton test. For this reason, and because tests involving smaller-yield explosions are less expensive, most U.S. nuclear weapons effects tests are in fact already conducted at quite low yields.[1]

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the Chairman of the Federation of American Scientists Fund, the research arm of the Federation of American Scientists. This testimony draws on the research that has been done in collaboration with Dr. Harold Feiveson and Christopher Paine.

[1] See, e.g., the listing of the yields and purposes of U.S. underground tests in R.S. Norris, T.B. Cochran and W.M. Arkin in *Known U.S. Nuclear Tests: July 1945 to 16 October 1986* (Washington, DC: Natural Resources Defense Council Report # NWD 86-2 (Rev. 1), October 1986.

Safety and Security.—Another technical reason that is given for continued testing is the need for design improvements in the areas of safety and protection against unauthorized use.

In fact, the safety of U.S. nuclear weapons is already quite good. Specifically, they are designed to be virtually immune from accidental nuclear explosion—even if a segment of the chemical explosives in the nuclear trigger is detonated by the penetration of bullet or by a fire.

Because the problem of accidental nuclear explosions seems to be under control, current work on safety improvements is focused on the much less serious problem of reducing the dispersal of toxic plutonium if the chemical high explosives should detonate or burn. An important advance in this regard has been the use in new nuclear weapons of "insensitive high explosives" that are much less subject to accidental explosions. Retrofitting the remaining nuclear weapons that still contain sensitive high explosives would require some nuclear tests but the process of substitution is well advanced and could, if desired, be brought to completion relatively quickly.

Virtually all other safety improvements are in the mechanical and electrical design of the triggering systems and can be adequately tested without significant nuclear explosions. One way in which this is done is by removing the chain-reacting nuclear material from the explosive and replacing it with non-chain-reacting material such as depleted uranium. The progression of the implosion is then followed with imbedded sensors and flash X-rays. Even more sensitive tests are sometimes conducted by partially removing the chain-reacting material, leaving only enough so that a very small nuclear explosion results. The production of neutrons from such a "zero-yield" nuclear test provides an extremely sensitive measure of the degree of compression that has been achieved by the chemical implosion. Such zero-yield nuclear tests would not be barred by the lowering of the test ban threshold to one kiloton or even below.

Virtually all significant improvements in the permissive action links and self-disabling features protecting U.S. nuclear weapons from unauthorized use also involve changes in their electrical and mechanical design that can be adequately checked out with nonnuclear or zero-yield nuclear tests. At the moment, however, the most serious obstacle to making the U.S. nuclear weapons more terrorist resistant appears to be institutional rather than technical: the U.S. Navy's refusal to have permissive-action links installed in all the nuclear weapons under its control.

Reliability Tests.—The final purpose for nuclear weapons tests—and the one that apparently played a key role in derailing President Carter's efforts to achieve a comprehensive test ban—are tests of fixes of problems that are detected in already deployed nuclear weapons.

The first point that should be made here is that random tests of weapons already in the stockpile make a negligible contribution to the detection of problems. Prohibitive numbers of tests would be required to maintain confidence in the stockpile in this way. The principal way in which problems are detected and rectified is by disassembly and inspection and by nonnuclear tests.

The latest and most specific official statement concerning the need for nuclear reliability tests is the following: "one third [14 out of 41] of all weapons designs introduced into the stockpile since 1958 have encountered reliability problems . . . [of which] 75 percent were discovered and/or corrected as a result of nuclear testing." [2]

Thus far, information on eight of these fourteen cases has been made available for review by Dr. Ray Kidder, an experienced weapons designer at the Livermore Laboratory who has in the past demonstrated a willingness to take an independent position on such questions.

Dr. Kidder has concluded that none of the eight cases can be used to support the argument that nuclear testing is required to deal with reliability problems in fully tested designs. For example, he finds that one half of the cases that have been cited by the Department of Energy and have been made available for his review involved weapons that were placed in the stockpile before undergoing a full program of certification tests because of the 1958–61 testing moratorium.[3]

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[2] Paul Brown, Assistant Associate Director for Arms Control, Lawrence Livermore National Laboratory, "Nuclear Weapons R&D and the Role of Nuclear Testing," invited talk at a meeting of the American Physical Society, San Francisco, 28 January 1987.

[3] The cases of the W45, W47, W52, W56, W58 and W68 are reviewed by Dr. Ray Kidder in an unclassified report, "Evaluation of the 1983 Rosengren Report from the Standpoint of a Comprehensive Test Ban" (Lawrence Livermore National Laboratory report No. UCID–20804, June 17, 1986). Kidder gives but does not explain his conclusions concerning the W80 and W84 in an unclassified letter to Professor Frederick Reines, Chairman of the University of California Scientif-

Based on Dr. Kidder's review, it appears that the weapons laboratories have overstated the need for reliability testing. This conclusion is supported by other senior former weapons designers and arms control experts who have had access to the relevant classified information.[4] However, it is impossible for an outside observer like myself who has not had access to classified information to judge whether the laboratories' claims are completely without foundation. The Congress might therefore consider commissioning an independent outside review of the issue—perhaps under the auspices of the Office of Technology Assessment or the National Academy of Sciences.

Significant further limitations on nuclear weapons tests could be agreed to, however, even while we await the final clarification of this issue. This is because:

i. Only a few percent of all nuclear tests are reliability tests, and

ii. These reliability tests could be conducted below a threshold set at about 10 kilotons.

With regard to the frequency of reliability tests, the Department of Defense has informed this Committee that, during the period 1970–85, only eight tests—an average of one every two years—were justified by the need to test the remedy of a defect in an already-deployed nuclear weapon.[5] This should be compared with the average of approximately 20 nuclear tests per year for all other purposes during this same period. It would therefore appear that a quota of less than one test per year could deal with the concerns that have been raised about the need for nuclear tests to fix problems found in the stockpile.

With regard to the yields required, concerns about reliability appear to focus almost exclusively on the finely-tuned "boosted" fission explosives that are used to ignite the thermonuclear reactions in the second more powerful stage of modern strategic warheads.[6] The yields of most US primaries fall in the range 5–15 kilotons and the consensus of weapons experts seems to be that reliability testing can be done at less than full yield. A lowering of the testing threshold to about 10 kilotons would therefore not significantly impair our ability to test fixes to problems with the primaries.

A POTENTIAL CONSENSUS POSITION

Based on the above discussion, it appears that there are two steps required to achieve a consensus position on further limits on nuclear testing.

First, it is necessary to achieve political agreement that the world would be a safer place if we didn't have the U.S. and Soviet nuclear weapons laboratories continually promoting what they claim are more useable nuclear weapons. I think that, after more than a decade of discussions of the controllability and consequences of so-called "limited" nuclear wars, we may be within sight of such an agreement.

Secondly, we must achieve a broader understanding that testing for purposes of determining nuclear weapons effects and for testing safety and security can be done below a very low threshold such as one kiloton and that any required reliability testing can be carried out within a quota of one test a year at a yield of less than 10 kilotons.

A MORE COMPREHENSIVE TEST BAN?

Many arms controllers would advocate still more stringent limitations on nuclear weapons testing. Richard Garwin, for example, would allow "explosive releases of nuclear energy taking place only in permanently occupied above-ground buildings, within 30 meters of personnel." [7] This limit would correspond to a limit of about 10 tons nuclear yield.

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ic Advisory Committee, 8 January 1987. The associated classified report by Kidder is entitled "Evaluation of Recent Problems with the U.S. Stockpile of Nuclear Weapons from the Standpoint of a Comprehensive Test Ban (CTB)."

[4] See, e.g., the letter to the Honorable Dante Fascell, Chairman of the House Committee on Foreign Affairs, from Hans Bethe, Norris Bradbury, Richard Garwin, Spurgeon Keeny Jr., Wolfgang Panofsky, George Rathjens, Herbert Scoville, Jr. and Paul Warnke, 14 May 1985.

[5] Answer to a question from Senator Carl Levin for the record in *Nuclear Testing Issues*, hearing before the Senate Armed Services Committee, 29 April 1986, p. 46.

[6] Donald R. Westervelt, "Nuclear Weapons: The Role of Laboratory Tests," paper presented at the SIPRI/CIIPS symposium on *A Comprehensive Test Ban: Problems and Prospects*, Ottawa, Canada, 23–25 October 1986.

[7] Richard Garwin, "The Administration's Case Against a Comprehensive Test Ban is Wrong," Federation of American Scientists Public Interest Report, December 1986, p. 13.

In justifying such a low threshold, it is argued that:

Means other than nuclear tests are sufficient to maintain stockpile reliability;

Nuclear weapons effects tests can be adequately carried out at these very low yields;

Intelligence derived from non-seismic means could identify any significant program of sub-kiloton tests; and

There would be a very significant nonproliferation benefit to a Comprehensive Test Ban that would not be realized with, for example, a 1-kt Threshold Test Ban.

VERIFICATION OF THE 150-KT THRESHOLD TEST BAN

Finally, I would like to return to the question of immediate concern to the Senate: the ratification of the 150-kiloton Threshold Test Ban, and the Administration's reservation relating to additional verification requirements—specifically the on-site CORRTEX method.

Two weeks ago, I participated in an International Workshop on the Verification of Threshold Test Bans which was held in Moscow. U.S. experts from Los Alamos were originally supposed to present the Administration's position on CORRTEX there but, at the last minute, the Administration decided not to send them. The Workshop is therefore of interest principally because it provided a first opportunity to hear a Soviet critique of the CORRTEX technique.

Basically, the position presented by the Soviet experts was that, while CORRTEX can be a relatively reliable means for a country to monitor its own tests, it would not be reliable in an adversarial situation. They described various uncertainties and potential evasion methods which they felt could result in uncertainty factors for the yield estimates from CORRTEX as large as 2–3—far larger than the uncertainty range of 1.3–1.5 that is estimated for seismic yield estimates by independent U.S. seismologists.

The Soviet CORRTEX experts acknowledged that the various uncertainties and evasion possibilities could be dealt with by detailed inspections of the geology and testing arrangements. But they felt that these inspections would have to include the inspection of the interior of the large canisters that contain the nuclear explosive and diagnostic equipment. They felt that such inspections would be unacceptably intrusive for the weapons labs.

Pending the translation of the Soviet paper, I can say little about its quantitative conclusions. Qualitatively, however, its conclusions are consistent with those that were arrived at by Professor Frederick Lamb in a review of the CORRTEX technique done for the Senate Foreign Relations Committee.[8] Similar concerns about the potential intrusiveness of the inspections required to ensure the accuracy of CORRTEX measurements have also been expressed by the U.S. weapons labs.[9]

Senator EXON. Gentlemen, thank you very much for your tremendously interesting testimony. We will proceed with the 6 minute rule. Let me start out.

First, I would like to ask Dr. von Hippel a question. You just recently came back from the Soviet Union. How recent is that and for how long were you there?

Dr. VON HIPPEL. I was there about a week and a half. We had two workshops there, and you have probably read about the forum that they held there, which ended with a meeting with General Secretary Gorbachev.

Senator EXON. The news here was that Gorbachev was going to come out with some new initiatives there. He came out with none.

Was it anticipated by yourself and others who were there that he would come forth with something new?

Dr. VON HIPPEL. Yes. That is the way it was advertised also to us. I think they may have changed their minds.

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[8] Frederick K. Lamb, "Monitoring Yields of Underground Nuclear Tests" (University of Illinois, Department of Physics, 31 January 1987).

[9] See e.g. the prepared statement of Roger Batzel, Director of the Lawrence Livermore National Laboratory in this hearing.

Senator EXON. So you think maybe he had something and they decided not to go?

Dr. VON HIPPEL. That is the speculation.

ABM TREATY

Senator EXON. In your deliberations there, did the ABM Treaty come up at all?

Dr. VON HIPPEL. Yes, Mr. Chairman.

There was another workshop on the ABM Treaty.

Senator EXON. And you attended that one?

Dr. VON HIPPEL. Yes, I participated in that one.

Senator EXON. That also is of major concern to this committee. I would just like to ask you what did you pick up as to their attitudes on our present attitudes, which seem to change from time to time, on the ABM Treaty?

Dr. VON HIPPEL. Well, there seemed to be a great interest on the Soviet side in a suggestion that was made from the U.S. side, that the controversy could be clarified by setting quantitative criteria about what was a weapon and what was not a weapon. For example, a test of a laser in space below a certain level of power would not be a weapon test and above that power level it would be a weapon test.

The Soviets were quite open in saying that they would be very happy to have discussions along those lines in Geneva.

Senator EXON. Did the matter of the suggestions coming out of the United States Senate and elsewhere today with regard to the new interpretation of that treaty come up at all in the discussions, either informally or formally?

Dr. VON HIPPEL. There were complaints from the Soviets about that.

Senator EXON. Complaints?

Dr. VON HIPPEL. Yes.

They argued that this was completely inconsistent with the law of treaties and so on. Of course, since I am not a lawyer——

Senator EXON. That is two of us.

Dr. VON HIPPEL [continuing]. I could not really offer my opinions on that. But they certainly were unhappy.

SOVIET VIEW OF TREATIES

Senator EXON. Do they look at these different treaties in isolation, as we tend to do? You know, we heard a lot of testimony this morning and there is, basically, distrust of the Soviets throughout America, and it permeates America's representatives here in the Congress, including myself.

Do they claim that we have violated the 150 kiloton limit, for example?

Do they have the same concerns over there that were expressed earlier in our hearing this morning, about the fact that we don't know what the Soviets are doing, that we can't be sure, that we don't know, and the administration says it is very likely that they have violated? Do they think we have violated the 150 kiloton testing limit?

Dr. VON HIPPEL. Well, I think they could construct such an argument. But they seem to be much less interested in raising that as an issue than people on our side do.

I might add, though, concerning the connection between different treaties, there was an interesting debate that went on there. Andrei Sakharov was participating in this meeting, and I spent a couple of evenings with him discussing this subject. The debate was over whether the Soviets should separate their discussions of reductions from the discussions of the SDI and the status of the ABM Treaty.

As you know, the Soviet Government has been insisting that the SDI issue be settled first before they talk about reductions. But Sakharov was arguing that they should separate those two issues. His argument was, basically, that he thinks that the SDI is so absurd on the face of it——

Senator EXON. Is so what?

Dr. VON HIPPEL. Is so absurd—that the proposal for these space-based systems is so absurd on the face of it that they will never be deployed. Sakharov argued that if the Soviet Union went ahead with a reductions agreement, the U.S. Congress would probably be disposed to insure that a space-based ABM system would not be deployed.

Senator EXON. Mr. Sakharov has been widely quoted here as one of the outstanding men of all time with regard to standing up to the Soviets. He is telling the Soviets that we are absurd in going ahead with SDI?

Dr. VON HIPPEL. Well, it was in the context of a criticism of the Soviet Government position. He was criticizing both governments at the same time. He was criticizing the Soviet position of trying to resolve the controversy over the ABM Treaty before talking about reductions. He was arguing that they should not require that the SDI issue be settled first.

His reason was criticism of the SDI program.

Senator EXON. I see. Everybody is talking about a lot of nonsense, in other words.

Dr. VON HIPPEL. Yes.

ESTIMATING SOVIET YIELD

Senator EXON. Dr. Richards, what level of confidence in estimating Soviet yield do you believe can be attained through seismology alone, assuming the Soviets agree to some form of reciprocal in-country monitoring stations?

Dr. RICHARDS. The answer to that question would, in part, be based on the argument that it cannot be just a technical discussion because one would have to come to perhaps some political judgments on whether certain numbers, for example, that the Soviets might give you could be used or not, in your overall procedure for estimating their yields.

For example, the Soviets have let a group of U.S. seismologists do some monitoring near their test site. They may have done that to embarrass the United States, or whatever. But they have done this and we are getting some data from that source. In a sense, that is Soviet-supplied data.

I have some examples of these seismograms here. Can we learn anything from them or not and fold that into the process which answers your question?

At the moment, there seems to be some political judgment about whether one is allowed to fold in information of that sort.

However, let me answer the question purely from a technical point of view. If one accepts numbers, some of which may be derived from the Soviets, and sets up purely a technical procedure, I think the factor of uncertainty would come out at about 1.5.

Senator EXON. Thank you.

My time is up.

Senator Thurmond.

Senator THURMOND. Thank you very much.

We are glad to have you gentlemen here.

I would like to propound this question to all three members of the panel.

Will critical technical uncertainties regarding yield verification remain even with the installation of CORRTEX at Soviet test sites?

Mr. NORDYKE. Well, let me take a crack at that first.

I believe there will still be uncertainties related to the yield estimates that you get from the CORRTEX measurements. The CORRTEX measurements are no different in principle than seismic measurements except they will have a smaller uncertainty associated with the yields.

You will still have measurements which appear to exceed 150 kilotons, and you will still be wrestling with the fact that there is a 5 percent probability that the yields will lie outside the 105 to 195 kiloton range.

And you will still have to deal with the question of compliance in a statistical way.

Dr. RICHARDS. I would like to contribute part of that answer, too, concerning its use of methods other than seismic to estimate yield. If one nation is testing right up to the threshold, there will, indeed, occasionally be estimates that come in still over 150. So, one perhaps then has to go on to ask the additional question: could that happen to a degree that has any military significance? In fact, I think that was the format that we were asked to address, as I heard you this morning, Mr. Chairman.

In that context, there has been given a very specific answer by the former Director of Los Alamos, Dr. Donald Kerr.

In testimony in May 1985, he was asked the question suppose we think that a Soviet test is 150 kilotons, but actually we are wrong, and they really did test 30 percent higher than that—in other words, that they really did test at 195. Dr. Kerr was asked, do you believe that has any military significance? He very forthrightly said no.

Dr. VON HIPPEL. I guess I would say that in a slightly different way.

Apparently the uncertainty, when this treaty was first negotiated in 1974, was thought to be a factor of two, which was not considered critical.

Now, apparently, the seismologists can estimate the yields to a factor of 1.5. Perhaps with CORRTEX, if you actually were able to

carry out all of the required, very intrusive inspections, the uncertainty would be a factor of 1.3.

None of those uncertainties are critical, in my view. That is the same view that the weapons labs apparently had in 1974.

Senator THURMOND. I would like to propound this question to all members.

CORRTEX ON-SITE VERIFICATION

What is your view of the technical community's assessment of the CORRTEX method of direct, on-site verification? Is there agreement that this can provide yield measurements accurate to within 30 percent?

Mr. NORDYKE. Again, let me take the first crack at that.

I believe the data that we have available indicate that in a routine situation, it will give an accuracy which is within 30 percent.

One can conceive of circumstances which would raise questions as to whether you can maintain the 30 percent, and that means that you have to impose certain restrictions on the geometry in order to assure that you can get 30 percent.

So, in summary, I think you can define a regime for the CORRTEX measurement which will give you a 30 percent accuracy for emplacement in satellite holes, as has been suggested.

Senator THURMOND. Dr. Richards.

Dr. RICHARDS. Sir, I will duck the question simply because I claim to have no professional competence in knowledge of the CORRTEX method. My contribution here is simply as a seismologist, to say that that isn't bad either.

Senator THURMOND. Dr. von Hippel.

Dr. VON HIPPEL. Based on the reviews that I have seen, in practice, you could not do it in an adversarial situation with a full weapons test. You couldn't do it within 30 percent.

You could, however, do the 30 percent measurement for the calibration shots, where you could be much more intrusive, since sensitive information would not be involved.

YIELD UNCERTAINTY BETWEEN 150 AND 300 KILOTONS

Senator THURMOND. Mr. Nordyke, in this morning's hearing, we received testimony about the increasing importance of yield uncertainty between 150 and 300 kilotons. Your testimony implies that you do not agree.

Would you expand on your views on this?

Mr. NORDYKE. I think what I would say is that you should not be surprised if you get yield estimates which are in excess of 150 kilotons, seismic yield estimates which are in excess of 150 kilotons, even by as much as 200 or 220 or 230 kilotons.

This is certainly what you would expect with the uncertainties that have to be associated with seismic yields.

The assertion that the Soviets could carry out a 300 kiloton or larger explosion and have the results look to us like they were within our random uncertainty, that we would expect for an explosion that was actually at 150 kilotons, would require, one, that the Soviets would have to be very lucky in order to have a 300 kiloton or a 400 kiloton look like it was only 180 or 200 kilotons; and,

second, they would have to deal with the probability that a 400 kiloton explosion, say, would have a 10, 20 percent probability it could look like 600 or 700 kilotons.

So I think one can say quite categorically that there have not been any explosions as large as 300 kilotons today, because they would have to be extremely lucky to carry out one that was at 300 kilotons that we wouldn't think that it was a violation. That is my opinion.

Senator THURMOND. I believe my time is up, Mr. Chairman. I have two more questions that I will ask later.

Thank you, Mr. Chairman.

Senator Nunn.

Chairman NUNN. Mr. Chairman, I will just yield. You all go ahead and I will come back.

Senator EXON. I have already had a round, but I do have some more questions.

Chairman NUNN. Well, then, please go ahead.

Senator EXON. All right, thank you.

VERIFICATIONS METHODS

Mr. Nordyke, you have presented a very interesting proposal for making the TTB and PNE Treaties effectively verifiable by first conducting some calibration shots and, second, through some extensive data exchange. Under your proposal, CORRTEX would not be required on-site for all tests above 75 kilotons. Is that basically correct?

Mr. NORDYKE. That's correct.

As I indicated, it seems to me the first level, the most significant level of improvement in verification would be to have data directly from the Soviet test site and, specifically, I think to verify the yields of the explosions which are already provided for in the treaty. There already is a provision in the protocol of the treaty for two calibration explosions in each area.

But there is no provision to verify the yields of those explosions.

What I am suggesting is that we can use the terms of the Peaceful Nuclear Explosions Treaty, which were hammered out in a year and a half of negotiations in Moscow, use those provisions as they stand to carry out PNEs at the test site and call them calibration explosions.

Senator EXON. I assume that you have seen the text on reservations on verification approved by the Foreign Relations Committee. This calls for, and I quote their statement: "direct, accurate yield measurements taken at the site of all appropriate nuclear detonations." The key words here seem to be "all appropriate," which is somewhat subjective.

In your opinion, is your proposal consistent with the Foreign Relations Committee's reservation, or, in other words, would you say that the appropriate number of tests for which CORRTEX is required might simply be those initial calibrations and those initial shots called for under your proposal?

Mr. NORDYKE. I would believe that the report, as you read it, would be satisfactory because I believe that one could very honestly

take the position that the calibration explosions are the appropriate explosions that should be verified.

Senator EXON. I am going to ask each of you a broad question. I am going to ask you to toss your scientist hats out the window and become politicians. In other words, I want you to play United States Senator or someone who has a heavy responsibility in this area, which we take very seriously.

Could you or would you play United States Senator for just a moment and give this committee, for the record, your suggestions on how we should proceed, and upon what reservations.

I have suggested earlier that maybe one way out of the present dilemma would be to recognize that this is not the time to be making significant changes in treaties. Would a reasonable compromise be to say that we are going to continue this for at least a year, but in the interim, we want to go ahead with negotiations with the Soviets on some type of mutually agreed improvement in verification, which seemingly would be in the interest of both sides, if both sides are indeed sincere?

If you want to comment about the ABM Treaty and how that fits in I would appreciate that, too.

I am sure that question will take the rest of my 6 minute allocation.

Who wishes to start? Are there any volunteers?

Who will be the first actor for United States Senator?

Dr. VON HIPPEL. I think that, if the U.S. position is that all Soviet weapons tests above 75 kilotons will have to be measured by CORRTEX, we won't get anywhere on that.

If the United States is willing to make a compromise of the type that Mr. Nordyke has outlined, taking into account the fact that in the treaty we do not have verification of the yields that the Soviets would give us for the calibration shots, and that we could ask for on-site verification with CORRTEX of those calibration shots, I think that would be a very good compromise.

But I will not preempt your Senatorial hat and advise you as to whether, in fact, the administration would be willing to make that compromise.

ABROGATING THE TREATY

Mr. NORDYKE. I guess I would say, first, among the options available, to abrogate the treaty is the most undesirable, because that certainly takes away an advantage that the treaty conveys to the United States of limiting Soviet testing.

Senator EXON. If I may interrupt you, I thought it was interesting when you were talking earlier about the fact that if we were to abrogate this treaty, it would probably be the nicest little nest egg that we could hand the Soviets from the standpoint that they are prepared to go ahead with heavy testing and we are not.

Mr. NORDYKE. I think that is exactly right. Our relative geographies are asymmetrical, as are our societies, and they have greater freedom to go to high yields than we do.

So I think abrogation is the worst approach.

The status quo is really my second worst approach because the status quo allows the TTBT to remain a source of contention. And

if they are cheating to some degree, they are continuing to cheat without any provisions for enhancing verification.

I think the next option would be to ratify the treaty as it stands, because that would do a number of things.

One, it would require them to declare their test sites where they are going to carry out tests.

Second, it would require them to convey a large body of data to us about their test site, and a large body of data about peaceful nuclear explosions, of which they have carried out over 50 since the treaty was signed, and have not given us any information whatsoever.

Third, ratification of the TTBT as it stands would also provide for establishment of the Joint Consultative Commission, which is designed to deal with these issues.

So, there is a variety of benefits from ratifying it as it stands, which would be better than our present situation.

Fourth, and most desirable, is to try to improve the defects in the treaty, which is the lack of verification of the data exchange package. As Dr. von Hippel said, I believe the Soviets would be willing to agree to some form of that.

The last, obviously the best verification would be what the administration has proposed. But I think if the result of holding on to that would lead us to abrogation or continuation of the present situation, I think it is to our negative benefit.

Senator EXON. Thank you.

Dr. Richards.

Dr. RICHARDS. Well, sir, if the ball were tossed to me, I would have two or three questions to ask before I would make my mind up.

Senator EXON. Oh, that is not fair.

Dr. RICHARDS. I will still say that I do not quite understand what is meant by "direct, accurate yield measurements." I really don't understand what is meant by "effective verification." Although I am standing in here as the junior pseudo-Senator from New York, I still have technical training and so I ask these technical questions.

I don't know what those phrases mean.

I would also say if one is to come up with an answer purely in the context of the Threshold Treaties, if you want me to give you an answer, my feeble answer would be to just acknowledge the process that has happened and say that I have no conflict with the text approved by the Foreign Relations Committee.

However, if the question is asked in the context of taking further concrete steps toward further restraints on testing, which I know is language that the administration has offered here, then there are some very specific things to be done.

I think it would be very helpful indeed, if we had some in-country seismic stations—in the Soviet Union that is—on a more regular basis than the current nongovernmental agreement. I think that builds a base for future policy options in testing restraints.

Senator EXON. Given the House of Representatives' strong views, which are so severe that it almost broke up the conference between the House and the Senate last year with regard to the Defense authorization measure, and, given the compromise proposal that was

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basically worked out by Senator Nunn and Senator Warner after an awful lot of hard bargaining, I would simply say that the House of Representatives' position, as I interpret it, is that they want to reduce that down to 100 kilotons and then move on down from there, or move aggressively ahead, depending on how you want to phrase it, for further restrictions, which we all would like to see.

I am mainly concerned about the fact—and this is a political judgment on my part—that there seem to be signals coming out of the Soviet Union today that they want to have some kind of understanding.

The Defense Minister from Italy was here the other day and he told us that he felt for the first time in a long, long time, that maybe this is one time when the Soviet leadership needs America more than America needs the Soviet Union.

Possibly, this is because Gorbachev may not be as strong as we think.

The reason I am trying to ask you these questions is to get your advice as knowledgeable experts on the technical and scientific side—which most of us are not—as to how we should proceed.

I guess I do not want to see us let slip an opportunity on all of these things, where the ultimate goal, of course, is to lead to some kind of workable, verifiable arms reductions with the Soviets.

My time is up. If you want to respond to that later, you can, after you think about it.

I would like to recognize Senator Thurmond now for the second round. I believe he indicated he had some additional questions.

Senator THURMOND. Thank you, Mr. Chairman.

I have this question for all three panel members.

Mr. Nordyke, let's take you first.

What are the practical implications of a reliance solely on improved teleseismic means of verification? How long would it take to install such a system?

What degree of Soviet cooperation would be required in the siting and provision of necessary geologic data?

Mr. NORDYKE. Let me ask a question about your question, Senator. Would that be relative to teleseismic verification?

Senator THURMOND. Yes, that is right, reliance solely on improved teleseismic means for verification.

Mr. NORDYKE. Teleseismic verification of the 150 kiloton limit utilizes stations that exist at the present time. A hundred kilotons is large enough that every seismometer in the world sees it. So you can use existing seismic stations in our own country as well as other countries around the world for teleseismic verification of the present limit.

If you were to go to lower yields, if you were to go down to significantly lower yields, then there could be a need for internal seismic stations to make sure you get all the seismic signals.

Senator THURMOND. The second question is how long would it take to install such a system, and what degree of Soviet cooperation would be required in the siting and provision of necessary geologic data?

Mr. NORDYKE. I think a teleseismic system is in existence. Nothing would be required. No Soviet cooperation would be required because it already exists.

If you wanted to go to significantly lower thresholds, you would need internal stations. The number of three to five has been tossed about. You would certainly need Soviet cooperation to put those in.

Senator THURMOND. Dr. Richards.

Dr. RICHARDS. I agree, sir.

The systems are in place right now for this kind of monitoring.

Senator THURMOND. Dr. von Hippel.

Dr. VON HIPPEL. I have nothing to add, Senator.

Senator THURMOND. All right. Dr. von Hippel, I have a couple of questions to ask you.

NUCLEAR TESTING REQUIRED

Do you share the view that nuclear testing will be required to assure the United States a capability to put at risk hardened or deeply buried Soviet targets as part of our deterrence policy?

Dr. VON HIPPEL. I guess the question relates to whether we need an earth penetrating warhead, or that is the way I interpret it, anyway. If, in fact, a new warhead were required for that purpose, then it would have to be tested.

I happen to disagree that that mission is desirable, and, therefore, I would not say that that was an argument against the test ban.

Senator THURMOND. Dr. von Hippel, do you share the view that was expressed in this morning's hearing that nuclear testing will be required to assure the survivability of our command, control, communications and intelligence assets?

Dr. VON HIPPEL. There I think testing might be required, but it could be done with very low-yield weapons. So it is not inconsistent with a very much reduced threshold, for example, down to one kiloton.

Senator THURMOND. Those are all the questions that I have, Mr. Chairman.

Senator EXON. Gentlemen, I cannot tell you how much we appreciate the information that you have given us. We have no further questions on this end.

Are there any concluding remarks or any summations that you have? We would like to recognize you for that.

Mr. NORDYKE. Could I take you up on your offer for a bit of philosophizing.

It seems to me, when I look at the future, that developing an agreement in almost any other test ban area is an extremely complicated and complex issue, which would take a long time and would take a long time for Senate approval as well, I am sure.

The threshold test ban is the one area where I believe all of the pieces are in place, in which agreements could be reached fairly quickly, subject to Soviet agreement, of course, which would be a significant arms control step, which would lead, if we were successful in getting even the calibration explosions, to on-site verification by teams from each country going back and forth, setting up an additional mechanism for discussing compliance issues with the Soviets, and at essentially no cost, in the sense that we are already performing as if we were under the treaty. The only thing that is lacking is the ratification action.

So it has just seemed to me for a long time that moving forward with the TTBT is something which would be easy to do in a relatively short length of time and have basically no downside to it.

Senator EXON. Thank you.

POLITICAL SITUATION IN THE SOVIET UNION

Dr. VON HIPPEL. I also would like to take you up on your earlier invitation to comment on the political situation in the Soviet Union.

I was asked to make the statement for the scientists at the recent forum to General Secretary Gorbachev. I said that in our view, if he continued to open up the Soviet Union and to make it more democratic, that could be the best thing that he could do for disarmament.

I think, although they are far from the kind of openness and democracy that we are used to here, this is really the best Soviet leadership we have had. They do need some success. Gorbachev needs something to show for his unilateral moratorium, for example. I think it would be in both our interests to consummate some disarmament agreements, perhaps starting with the Threshold Test Ban Treaty.

Senator THURMOND. There is only one thing the Soviets would have to do, and I think the whole world could be at peace: abandon their goal of spreading aggression throughout the world. If they want communism in Russia, they have a right to have it. But they have no right to impose that on Ethiopia, Nicaragua, Afghanistan, and other countries in the world.

So if you can get that word to them, just abandon the goal of world aggression, we can all live in peace.

Senator EXON. Gentlemen, is there anything further?

[No response.]

If not, I want to thank each and every one of you very, very much. If you come up with any magical solutions to the problems that we will deal with here, please get in touch with us. If I come up with any magical solutions to the intricate problems that you deal with, I will get in touch with you.

The hearing will now conclude here and we will reconvene the subcommittee for the closed portion of our hearing in S–407 at 3 o'clock.

Thank you very much.

Senator THURMOND. Thank you, gentlemen, for your appearance here today.

[Questions for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

Senator LEVIN. It is my understanding that the Livermore Laboratory has collected data on the seismic estimation of U.S. test yields since March 31, 1976. Since that date, how many U.S. tests have had magnitudes such that their estimated yields exceeded 150 kt?

Dr. BATZEL. The unclassified seismic magnitudes determined by the National Earthquake Information Service (NEIS) for the period from April, 1976 through December, 1986 have been analyzed using a general relationship between magnitude and yield for explosions at the Nevada Test Site. The relationship is one for explosions which occur below the water table.

[Deleted.]

[Deleted.] For earthquake studies, NEIS's intended purpose, it is sufficient to round the magnitudes off to the nearest 0.1 magnitude unit. This rounding off reduces the accuracy of the yield estimates using this data base. However, other data bases show similar patterns.

Senator LEVIN. Of those U.S. tests referred to, how many times did the actual yield of the test exceed 150 kilotons?

Dr. BATZEL. The most accurate estimates of the "actual yield" are based upon radiochemical methods. [Deleted.] All estimates of the actual yield, whether they are derived from seismic methods, hydrodynamic methods (CORRTEX), or radiochemical methods, have uncertainties associated with them. [Deleted.]

Senator LEVIN. Do the uncertainties in the yield estimation process give a pattern of U.S. tests estimated at over 150 kilotons similar to that of Soviet tests estimated at over 150 kilotons?

If yes, please describe the patterns, and give your view of the similarity between them.

Dr. BATZEL. Yes. [Deleted.] However, because of the statistical uncertainty of teleseismic yield estimates and the uncertainty in extrapolating U.S. experience to Soviet test sites, we cannot rule out the possibility that a few Soviet tests may have exceeded the limit. In summary, based on all the technical factors, I believe that it is impossible to state with certainty that the Soviets have or have not violated the TTBT.

Senator LEVIN. On September 8, 1977 you testified before the Senate Foreign Relations Committee regarding the TTBT. At that time you said: "As far as the verification provisions are concerned, I believe that even with the uncertainties in teleseismic measurement of yield, yields much above 150 kilotons, if conducted very often, would be detectable, and that in general the verifications provisions will protect the interests of the United States in that regard." Is that still your view?

Dr. BATZEL. Yes. Given the capability of the U.S. monitoring system and the fact that a potential evader knows that the detonation of a number of high yield events has a high risk that some of the explosions will have very large estimated yields, I believe that in general the interests of the U.S. are protected under the present provisions.

However, I have also testified that verification measures can be improved to provide a better balance between raising false alarms and missing violations. New technology is now available to enhance our verification capability and these improvements would increase confidence in the compliance evaluation process and reduce the basis for disagreements in the future.

NUCLEAR TESTING LIMITATIONS

Senator LEVIN. I would like to be supplied with the following information:

(A) Based on the new yield estimation methodology which Dr. Hecker of Los Alamos referred to in his testimony, how many Soviet tests conducted since March 31, 1976, have been "likely violations" as defined in the December 23, 1985, Report to Congress on Soviet Treaty Violations?

(B) What were the dates on which these likely violations took place?

(C) What were the low and high ends of the estimated yield range (or band) for each test which was determined to be a likely violation?

Dr. BARKER. As you know, the President's determination that the Soviet Union had likely violated the terms of the Threshold Test Ban Treaty was based on the totality of evidence and not just on the teleseismic estimation method to which you referred. The teleseismic data are themselves classified and are presented in the following table. However, because of the probabilistic nature of the yield estimation process coupled with the fundamental limitations inherent in the teleseismic technique, identifying a specific test as a violation is not possible unless the entire range significantly exceeds the permitted threshold.

[Deleted.]

Senator LEVIN. Dr. Barker, what is the military significance of the actual tests which the Administration has determined to be likely Soviet violations of the TTBT 150 kiloton limit?

Dr. BARKER. Because of limitations inherent in our monitoring techniques and our limited knowledge of Soviet nuclear weapon technologies, it is generally not possible to point to a specific test and to stipulate with certainty that the test constituted a violation nor to stipulate with certainty what the significance of that test might have been. However, if the Soviets have purposefully exceeded the 150-kiloton threshold on occasions, they have done so to further their nuclear weapons program. A more complete discussion of possible benefits which could have accrued to

the Soviets in testing above 150 kilotons was presented in the President's report to Congress dated January 23, 1984, "Soviet Non-compliance with Arms Control Agreements." Without getting into classified details, three generic benefits were discussed in the report. Specifically, by testing above 150 kilotons, the report indicated that the Soviets could be in a better position to maintain the reliability of their high yield weapons, to develop and certify new high-yield weapons, and to sustain a high-yield technology base.

Questions Submitted by Senator Edward M. Kennedy

Senator Kennedy. Please provide a table showing each test conducted in fiscal year 1986 and scheduled for fiscal year 1987 and fiscal year 1988 with the following information: size in kilotons, cost of the test, laboratory sponsor, purpose of the test (e.g., weapons development of which warhead, SDI test, stockpile confidence test, physics test, weapons effects), and a brief description of the need for the test?

Mr. Foley. The following tables associate the names of nuclear tests with their yields, laboratory sponsor, and the primary purpose to which they were directed. First, we have listed Department of Energy tests, then those sponsored by the Defense Nuclear Agency and, finally, those sponsored by the United Kingdom. Although we have stated the main purpose of each test, it should be understood that many tests have more than one purpose. We should also point out that the tests listed for fiscal year 1987 and fiscal year 1988 are not all certain to occur as planned. Nuclear tests are highly complex scientific experiments and are sometimes modified or deferred for technical reasons; e.g., to redesign hardware to assure the best possible data return, to redesign, defer, or even cancel a test due to a discovery in a near-term test, etc. In addition, because the details of tests planned for fiscal year 1988 are not yet firm, only general objectives and no yield information is included for those tests. The various activities associated with a test take place over several years from concept to design to execution to analysis. Costs associated with these activities are, in most cases, not collected on the basis of individual tests. However, sampling of incremental test costs indicate a normal range of $10 to $40 million for a test depending on its technical complexity.

Name	Laboratory	Design yield	Main objective
[Deleted.]			

MIGHTY OAK

Senator Kennedy. What exactly went wrong with the Mighty Oak test conducted on April 10, 1986? When were you finally able to reenter the tunnel?

Mr. Foley. MIGHTY OAK was a horizontal line-of-sight weapons effects test sponsored by the Defense Nuclear Agency conducted on April 10, 1986. Shortly after detonation, certain drifts containing experiments and recording instrumentation located in the underground tunnel complex were unexpectedly contaminated by radioactive debris. The radiation containment system prevented any radiation from escaping to the environment as result of the detonation. Initial reentry to the tunnel occurred on April 15, 1986.

WEAPONS YIELDS

Senator Kennedy. In testimony before the Senate Foreign Relations Committee last June, Donald Kerr gave some ratios for how large a test must be to scale upward to the weapons real yield. What is the largest weapon, in terms of yield, you can certify for the stockpile if there were a 1 kiloton test ban limit? What about a 5 kiloton and a 10 kiloton limit?

Mr. Foley. In discussing "scaling," Dr. Kerr described a particular situation in which, by substituting materials in a specific part of a thermonuclear weapon, a test can be performed at half of its full design yield and be adequate for certification of full-yield performance. This procedure does not apply to new designs that deviate significantly from those already tested at full yield. The situation is quite different when a weapon has been previously tested and certified and, for example, a problem has developed in the primary. In that case, recertification of the weapon may be possible on the basis of a primary test alone, [deleted].

NUCLEAR TESTS

Senator KENNEDY. Assistant Secretary of Defense Richard Perle states that all nuclear tests could have military significance. Would you define military significance and explain how tests of 1 kiloton or less are militarily significant.

Mr. FOLEY. A nuclear test will be militarily significant if the knowledge gained from it serves to preserve or improve the effectiveness, reliability, safety, or survivability of our nuclear deterrent, or if it otherwise contributes to the national security. Low-yield tests, even under 1 kiloton, can achieve such results but only within a very limited range of objectives. [Deleted.] One-point safety tests could be conducted at a fraction of a kiloton. [Deleted] some effects tests relating to the survivability of military systems in hostile environments are, or could be, conducted at low yield. Tests at or below 1 kiloton can be used to explore some physical regimes that are relevant to weapon design but are inaccessible through nonnuclear testing. On the other hand, subkiloton tests are inadequate for the purpose of assessing and/or resolving significant, possible problems in stockpile primaries, problems related to full-yield performance, and many other defense related issues.

WARHEADS

Senator KENNEDY. Excluding the W-78, B-83, W-87, and W-88, have there been any warheads introduced into the stockpile since the TTBT that have not been tested at full yield? Would a warhead be certified if it had not been tested at full yield?

Mr. FOLEY. [Deleted.]

WEAPONS IN EARLY DEVELOPMENT

Senator KENNEDY. Last year you provided me with a list of warheads that were in Phase 1 and 2 since 1975 but did not advance. In budget documents, for example in FY86, you included other warheads, such as those for the Small Atomic Demolition Munition and Tactical Follow-on Missile that are not on the list. Why weren't they on your list last year? What happened to them?

Mr. FOLEY. The Office of Military Application/Department of Energy (DOE) projected that a Phase 1 (Concept Definition) Study for a Small Atomic Demolition Munition (SADM) would be initiated by the Department of Army (DA) in FY 1986 and that DOE would be requested to participate in a joint study. Consequently, DOE projected a Phase 1 start for SADM in the FY 1986 DOE Budget Request. On October 18, 1985, DA sent DOE a formal request letter asking for assistance in a Phase 1 study for SADM. On November 25, 1985, DA sent DOE a letter requesting that the October 18, 1985, Phase 1 request letter be returned with no action. Consequently, subsequent DOE budget submissions have deleted SADM.

The Tactical Follow-on Missile (TACFOM) nomenclature is used in the President's Nuclear Weapons Stockpile Memorandum as an entry to anticipate the replacement for the Lance Missile system. The joint Department of Defense/DOE Phase 1 Study which supported the TACFOM entry was initially (1981) entitled Corps Support Weapon System Phase 1 Study and later (1982) renamed Joint Tactical Missile System (JTACMS) Phase 1 Study. This Phase 1 JTACMS Study was completed in 1983; subsequently, in October 1986, DA initiated a Phase II Study, renaming the system to Follow-on to Lance (FOL). Consequently, the term TACFOM will disappear and FOL will be used in its place in future budget submissions.

WARHEADS IN PHASE 1 AND 2

Senator KENNEDY. For each of the warheads that were in Phase 1 or Phase 2 since 1975 please provide a description of what weapons system it was intended for and why it did not proceed.

Mr. FOLEY. Phase 1 (Concept Definition) and Phase 2 (Feasibility) studies are conducted jointly by the Department of Energy (DOE) and the Department of Defense (DOD). In each of these study phases, the DOE laboratories provide proposals for several candidate warheads that may fill the general objectives of the study. Thus, there usually are several warheads but no specific one associated with these two phases. Based on the analysis of the candidates and the weapon system requirements, a set of Military Characteristics (MCs) is developed by the DOD in preparation for more advanced weapon phases.

The following is a list of weapon systems studied in Phase 1 and Phase 2 since 1975. It would be more appropriate for the DOD to state the reasons why certain of these systems did not proceed to more advanced phases.

Phase 1.—

Shallow burst munition,
Rapidly Deployable BMD System,
ADM (Atomic Demolition Munition),
Short range bomber defense missile,
SLCM (Sea Launched Cruise Missile),
Low yield RV for ICBM,
Tactical Tomahawk
Advanced Strategic Air Launched Missile (ASALM) (Multipurpose Missile),
ASW (Antisubmarine Weapon),
Longbow Medium Long Range Ballistic Missile (MLRBM) and Air Launched Medium Intermediate Range Ballistic Missile (ALMIRBM),
RDS [deleted],
[Deleted] Atomic Fired Artillery Projectile (AFAP),
Site Defense (LoAD),
Tactical ASM,
Super Safe Security Command and Control Warhead,
Trident II (D5),
Phoenix/AAIM,
AICBM (Advanced ICBM),
HEDS (High Endoatmospheric Defense),
SRAM II (Short Range Attack Missile),
SABRE [deleted],
HTK (Hard Target Kill),
ND/SB (Nuclear Depth/Strike Bomb),
SRT (Strategic Relocatable Targets),
AASM (Advanced Air-to-Surface).

Phase 2.—
155mm AFAP with ER,
ALCM (Air Launched Cruise Missile),
SLCM (Sea Launched Cruise Missile),
SRAM II (Short Range Attack Missile),
Harpoon SM-2,
Pershing II,
Site Defense (LoAD),
GLCM (Ground Launched Cruise Missile),
Mk 500 Trident,
ICBM Options-Supplementary Warhead,
Nuclear Standard Missile (SM-2),
ASALM (Advanced Strategic Air Launched Missile),
MX,
MMII Upgrade (Minuteman II),
ASW/VLA (Vertical Launch),
ASW/SOW (Standoff Weapon),
Trident II,
SICBM (Small ICBM),
ND/SB (Nuclear Depth Strike Bomb).

Senator KENNEDY. Please list all current warheads that will enter into or continue in Phase 1 (Concept Definition) and Phase 2 (Feasibility) Study, Phase 2A. In a separate table, list all current warheads that will enter into or continue in Phase 3.

Mr. FOLEY. The following are studies which may continue or enter into Phase 1, Phase 2, or Phase 2A in FY 1988 or FY 1989:

Strategic Relocatable Targets—Conventional Nuclear Effects and/or—Advanced Nuclear Effects,
Hard Target Kill—Bomber-delivered and/or—ICBM-delivered,
Cratering Utility Study,
Tactical Air-to-Surface Missile,
Sea Lance (Antisubmarine Warfare Standoff Weapon),
Follow-on to Lance.

The following systems are expected to enter or be in Phase 3 during FY 1988:
Short Range Attack Missile II,
Small Intercontinental Ballistic Missile (SICBM),
Nuclear Depth/Strike Bomb (ND/SB).

ANNUAL BUDGET FOR NUCLEAR EXPLOSIVE TESTING

Senator KENNEDY. Provide the annual budgets for nuclear explosive testing for the last 10 years and your future projections for the next 5. In a separate column, list the DOD/DNA share.

Mr. FOLEY. The following lists the annual operating costs for DOE nuclear test activities for the last 10 years and projections for future activities:

Annual Operating Cost and Estimates

Fiscal year:	*Million*
1978	$237
1979	209
1980	221
1981	227
1982	370
1983	416
1984	479
1985	518
1986	517
1987 [1]	549
1988 [1]	584
1989 [1]	560

[1] Estimates. The most up-to-date and complete data on the costs budget for DOD/DNA sponsored test activities are available from the DOD.

TESTING NUCLEAR DEVICES

Senator KENNEDY. Are nuclear devices tested during all seven Phases, from conception to retirement? In which Phase is testing more frequent?

Mr. FOLEY. Nuclear devices associated with a specific weapon system are generally tested only in Phase 3 (engineering development), Phase 4 (production engineering), Phase 5 (first production), or Phase 6 (production and stockpile). Generally, testing is more frequent in Phase 3.

Nuclear devices tested prior to engineering development are generally not associated with a specific weapons system. Tests prior to engineering development may be for such reasons as advancing knowledge or weapons physics, demonstrating the feasibility of a new concept, or studying the effects of nuclear explosions on weapon components, among others. Tests prior to Phase 3 may be used as part of the basis for a design which ultimately enters Phase 3, or as part of the body of knowledge used as the basis for certifying a device which ultimately is produced. Tests of weapons are, of course, conducted in Phase 6 to verify that the performance of production model warheads, upon entry into stockpile and later in their stockpile life, are consistent with predictions based on development tests. Tests of weapons in Phase 6 may also be necessary to evaluate the impact of changes that are detected in stockpile sampling and verify fixes when they are deemed necessary. Nuclear devices are not tested after retirement.

PICADON WARHEAD

Senator KENNEDY. In a fiscal year 1983 House Armed Services Committee hearing there is mention of a warhead termed the "Picadon." (Part 5, p. 344) What is the Picadon warhead and what happened to it?

Mr. FOLEY. The Picadon was one conceptual warhead design studied as a possible candidate for inclusion in the Peacekeeper (MX) strategic warhead. During the joint Department of Defense/Department of Energy Feasibility Study to identify the best warhead for PEACEKEEPER, this candidate design was dropped in favor of the design currently being deployed in the W87 warhead.

USE OF COMPUTERS IN TEST PROGRAM

Senator KENNEDY. An Aviation Week and Space Technology article of August 23, 1982 said that a certain weapon designed with a Control Data Corporation 6600 required 23 field tests while a newer one designed with a CDC 7600 required only 6. Have reductions in the number of tests per design continued with the introduction of the CRAY-1 and what do you foresee will be the pattern with frequency of testing with the CRAY-2? Do you foresee a time when supercomputers could make field testing unnecessary?

Mr. FOLEY. The same article also stated, "However, weapon design is one of the most empirical activities, and it is not yet possible to model weapon effects and responses completely . . . Consequently, some level of experimental testing will continue to be needed to evaluate the models and provide data for upgrading and correction."

There is no doubt that increased computer power helps to reduce nuclear testing requirements, although there are also factors, such as more stringent safety and security requirements and specific new design features, that have the opposite effect. There will probably never be a time when computer simulation alone can replace nuclear testing because there will always be important phenomena that cannot be completely modeled. Computer simulations are only as good as our understanding of the physics that is programmed into them. Applying the scientific method of iteration between theory and experiment is the only way to gain that understanding. Nuclear tests, even some of the most recent ones, continue to reveal surprises that do not show up in computations or nonnuclear laboratory tests. It should not be forgotten that thermonuclear weapons involve highly nonlinear and complex processes which represent a field of physics which we only now are beginning to develop some understanding. Development of a new weapon system still requires, on the average, between three and six nuclear tests. New, more powerful supercomputers can increase the value of our testing and give us more capability and options for design. They cannot, nor were they ever intended to, replace nuclear testing.

CTB AND RELIABILITY

Senator KENNEDY. If the reliability and safety of the existing nuclear stockpile could be assured without our having to conduct nuclear explosive tests, would you support a CTB?

Mr. FOLEY. Even though it is most difficult to accept the premise of this question, it still would not alter our view of a comprehensive test ban (CTB) since there are many responsibilities in maintaining a nuclear deterrent capability in addition to those for the reliability and safety of the existing nuclear stockpile. We also conduct nuclear tests to modernize the stockpile to ensure its effectiveness under changing conditions of dynamic deterrence and a continuing responsibility for the survivability of nuclear weapons and weapons systems subjected to hostile environments. We must also test to assess the vulnerability of weapons systems and command, control, communications, and intelligence assets to a nuclear environment and to maintain the scientific skills and technical judgment of our weapon scientists.

For the reasons just stated, nuclear testing would continue to be necessary. Under a CTB the United States would lose the capability to meet these requirements and would rapidly incur the loss of the ability to design new weapons and to maintain the reliability of the stockpile, despite the premise of the question.

SOVIET NUCLEAR TESTING

Senator KENNEDY. Last year you told me that "the Soviets could refrain from testing for at least a decade before there would be a militarily significant impact on their offensive nuclear forces." Back in 1977, Dr. Harold Agnew, then Director of the Los Alamos Laboratory, indicated that "with ample money, no restrictions on materials, and adequate non-nuclear testing the stockpile could be maintained as is for a period of at least ten years." Since there seems to be a consensus that a test ban would not impair reliability for at least a decade, wouldn't you agree that a CTB of 5 to 10 years duration would not be likely to threaten stockpile reliability?

Mr. FOLEY. The "consensus" referred to is not universally accepted and most certainly does not include those directly responsible for the United States nuclear weapons program. Based on the experience of the 1958–1961 moratorium, we would expect to encounter reliability and safety problems in the stockpile and to have a significant loss in qualified design and testing personnel after a period of 3 to 5 years. One-third of the weapon designs placed in the stockpile since 1958, or 14 or 41 weapon designs, have required post-development nuclear tests to resolve problems. In three-fourths of these cases, the problem could not have been discovered, or confirmed if suspected, without the ability to conduct nuclear tests. While we would normally not expect the reliability of the stockpile to be significantly impaired over a period of 5 years, it would be possible within that period for a serious problem to occur and remain undetected or, even though detected, not be able to be corrected with a confirmed fix. Clearly, a 5-year suspension of nuclear testing would carry less risk than one of 10 years.

NUCLEAN WEAPON FAILURE

Senator KENNEDY. Which of the explosive reliability tests conducted since 1970 have revealed the cause of a nuclear weapon failing to produce its normal predicted yield? Please specify the cause of the reliability problem each of these tests identified.

Mr. FOLEY. The causes of a nuclear weapon failure seldom, if ever, are revealed by the nuclear tests themselves. Rather nuclear tests have identified the existence of problems. Subsequent exhaustive analyses and additional nuclear and nonnuclear experiments then have provided data that enabled the weapons designers to determine the cause of failures. Additional nuclear testing has then been required to correct the problems and to confirm that a fix has, in fact, been achieved.

EXPLOSIVE RELIABILITY TEST

Senator KENNEDY. It has been stated that soon after a weapon system is deployed, it is current practice to conduct an explosive reliability test of the weapon. How long has this practice been in effect and what is the justification for conducting such tests? Why are such tests considered "stockpile confidence" tests rather than final production certification tests?

Mr. FOLEY. In 1981 the Departments of Energy and Defense executed a memorandum of understanding (MOU) to define procedures for the conduct of stockpile confidence nuclear performance tests as part of the overall process of assuring the viability of the nuclear weapons stockpile. There are some tests conducted earlier, even prior to the implementation of underground nuclear testing, that would meet the objective for stockpile confidence tests as stated in the MOU. It is agreed that the distinction between "stockpile confidence" and "final production certification" tests is somewhat artificial, as evidenced by the MOU reference to "stockpile confidence nuclear performance tests."

These tests are justified by the fact they are required to confirm the validity not only of the nuclear physics designs of the weapons, but also of all the many engineering decisions made during the conversion of the designs into production hardware. The weapons to be tested early in their stockpile life are usually taken from the stockpile within the first year after deployment. They do receive some limited stockpile environmental exposure, such as transport and handling by the responsible military services. Much older weapons which have been in the stockpile for a number of years have also been tested as a part of the stockpile confidence testing program.

NONNUCLEAR TESTING CAPABILITY

Senator KENNEDY. Lawrence Livermore Laboratory Director R. Batzel stated that the National Weapons Laboratories have seriously studied the possibility of acquiring experimental facilities that might augment our nonnuclear testing capability. Dr. Batzel has indicated that these repeated examinations have disclosed no reasonable facility capable of replacing nuclear tests. Please provide a list of all studies and reports conducted at the labs that have addressed this particular subject and summarizes their findings.

Mr. FOLEY. Experience gained over the years through nuclear testing, where failures have been incurred even in final development tests, clearly demonstrates that nonnuclear testing and computers are not a sufficient basis for deciding whether a nuclear explosive design will work. The list of studies and reports relevant to this question is too extensive to provide in this response. The following list, however, does exemplify studies of areas where laboratory experiments might aid the understanding of nuclear devices. In general, the tone of the reports is constructive, but none of them conclude that laboratory facilities could replace nuclear testing:

1. "Proposals for Laboratory Weapon Physics Experiments," C. T. Alonso, ed., LLNL document UCRL-53293; Vol 1 "Executive Summary" (60 pages); Vol 2 "Scientific Summary" (168 pages); May 30, 1983.

Summary of findings.—The proposed experiments cannot replace Nevada Test Site (NTS) weapon tests, because they cannot fully reproduce the unique conditions that are achieved in a nuclear weapon. In some cases, however, they can complement the NTS data by providing more readily attainable data bases that can be benchmarked into useful forms by the necessary but less frequently obtained NTS data. Take note that a good many of the laboratory experiments proposed in this document have already been carried out or are under active development.

2. "Nuclear Design Experimental Facilities Report," R. Staffin, Experimental Facilities Study Director, LLNL report MAY 83-13, October 14, 1983.

Summary of findings.—Experimental facilities can augment NTS NDEW (Nuclear Director Energy Weapon) tests, but cannot achieve very similar conditions, sometimes being off by orders of magnitude.

3. "Report of the Long-Range Planning Committee," M. May, Chairman; LLNL Report UCRL–53565, July 1, 1984.

Summary of findings.—This report has a section on experimental facilities which again states that they can augment but not replace NTS testing of NDEW devices.

4. National Academy of Sciences Review, "Applications of High-Gain ICF Capability to Weapon Physics;" presentation by R. D. Woodruff, LLNL Associate Director for Defense Systems; August 6, 1985.

Summary of findings.—If we knew how to build a high-gain ICF facility (a question debated by several recent committees), it could address certain weapon physics issues but it could not be used to replace full-weapon tests at Nevada Test Site. Most modern weapon secondaries operate on principles that do not scale down the many orders of magnitude necessary to reduce to high-gain ICF conditions.

ZERO-YIELD TESTS

Senator KENNEDY. Dr. Hans Bethe, in testimony to the Senate Armed Services Committee in April of 1986, spoke of zero-yield tests as a way to confirm the reliability of a weapon under a comprehensive test ban. Would you explain how they work? How many zero-yield tests has the U.S. conducted and for which weapon types? Do you agree that zero-yield tests would be a way to confirm the reliability of a stockpiled weapon? If not, why not?

Mr. FOLEY. We assume that the "zero-yield tests" referred to in the question are the hydrodynamic tests with H.E. detonation routinely conducted during the development of a weapon. In these tests the high explosive component of the weapon is detonated so that its effects can be determined. In particular, the prenuclear implosion of the primary can be diagnosed. These tests are conducted for virtually every weapon that is developed. They are another example of laboratory experiments done in support of understanding nuclear weapon operation. In these zero-yield tests, no nuclear yield is produced because there is no plutonium or oralloy involved in the test, and the crucial steps involved with nuclear energy production do not take place.

The phrase "zero-yield tests" could also refer to techniques used long ago which were called "hydronuclear experiments." In these experiments special care was taken to ensure that any criticality was carefully controlled so that essentially no nuclear yield was produced. They were used to answer safety questions that arose just before the testing moratorium circa 1960, and did not in any way address the yield certification issue.

STOCKPILED WEAPONS

Senator KENNEDY. Richard Perle has stated that since 1970 eight tests have been conducted to correct defects in stockpiled weapons. How many different warheads types were involved in the eight tests and when did they occur?

Mr. FOLEY. Without Secretary Perle's exact statement, we cannot be sure which warhead types he referred to. However, our records show eight tests related to identification and/or resolution of defects in stockpiled weapons during this period. The types involved included the B61, W68, W79, W80 and W84. The tests in question were in the years [deleted].

CONTINUED TESTING ESSENTIAL

Senator KENNEDY. On September 24, 1986 Frank Gaffney gave a briefing at the Pentagon on why the U.S. must continue testing. He presented a picture of a reentry vehicle that cracked during a weapons effects test. Which RV was it and did this necessitate removal and retrofitting of all the other RVs of that type?

Mr. FOLEY. We were not present at Mr. Gaffney's briefing and recommend that you request this information from the Department of Defense.

PROBLEM WARHEADS

Senator KENNEDY. In the same presentation, Mr. Gaffney listed warheads that had had problems. On the list were GLCM and SLCM. What problems were encountered with the warheads for those systems?

Mr. FOLEY. Mr. Gaffney addressed problems with the W80 (ALCM and SLCM) and the W84 (GLCM) warheads. [Deleted.] These problems were resolved by additional nuclear tests.

TESTING STOCKPILED WEAPONS

Senator KENNEDY. How many of the nuclear tests scheduled for fiscal year 1987 and fiscal year 1988 are tests whose primary purpose is stockpile confidence or reliability?

Mr. FOLEY. For fiscal year 1987 and fiscal year 1988, [deleted] stockpile related tests; however, all tests contribute to the data base on which stockpile confidence depends.

TTBT AND PNET VERIFICATION

Senator KENNEDY. The New York Times reports that CIA officials believe the Administration's current proposals for verifying nuclear testing agreements are "deficient" and fail to "meet the tests of comprehensiveness and technical soundness." The CIA reportedly recommends adoption of a testing verification package consisting of several parts. These findings and recommendations are reportedly contained in two memoranda dated December 4 and December 10 respectively. Do you agree with the findings and recommendations contained in these memoranda. If not, why not?

Mr. FOLEY. [Deleted.]

VERIFICATION OF NUCLEAR TESTING LIMITATIONS

Senator KENNEDY. How much funding has the Department of Energy requested for nuclear test ban verification in the fiscal year 1988 budget and fiscal year 1989 requests? What activities will be supported using these funds?

Mr. FOLEY. The Department of Energy's fiscal year 1988 and fiscal year 1989 budget requests are $65.0 million and $88.0 million for Detection Technology activities in the Verification and Control Technology program. The Detection Technology activity conducts advanced research, development and fabrication of nuclear other advanced technology weapon detection and characterization systems to support treaty verification requirements. Detection Technology contributes significantly to the national security requirements for arms control, verification and intelligence. The DOE is a major developer of the U.S. capability for monitoring and verification of nuclear and advanced weapon treaties. The fiscal year 1988 and fiscal year 1989 funding requests will be used to support verification technology research and development projects in the following areas:

On-Site Monitoring,
Satellite Instrumentation,
Seismic Verification,
Sample/Debris Detection and Analysis,
Non-Seismic Verification,
Directed Energy Verification,
Technology Development.

VERIFICATION AND CONTROL TECHNOLOGY

Senator KENNEDY. Did OMB make any reductions in the Department's fiscal year 1988 and fiscal year 1989 budget requests for Verification and Control Technology? If so, please indicate where these reductions were made and explain what their impact will be on DOE verification programs and activities.

Mr. FOLEY. The OMB did not reduce the Department of Energy fiscal year 1988 and fiscal year 1989 budget requests for Verification and Control Technology.

COMPREHENSIVE TEST BAN TREATY

Senator KENNEDY. What studies have been conducted to evaluate the efficiency of an integrated Comprehensive Test Ban Treaty monitoring system (i.e., one consisting of existing and currently planned National Technical Means of Verification operating in conjunction with various types of in-country monitoring networks and auxiliary provisions such as on-site inspections)? Please summarize the findings of these studies.

Mr. FOLEY. The DOE has not performed such an evaluation and is unaware of any other agency actions in this area. It would be difficult if not impossible to evaluate such a system since, in addition to National Technical Means, a Comprehensive Test Ban Treaty would require on-site inspection and regional Seismic arrays. At present, the efficiency or effectiveness of such required activities could only be estimated.

SEISMIC SIGNALS

Senator KENNEDY. What field and laboratory programs are underway to improve U.S. capability to characterize the seismic signals from explosive sources (particularly at low yields) and what is the funding level for such programs in the fiscal year 1987 and fiscal year 1988 budgets.

Mr. FOLEY. The characterization of seismic signals from explosive sources for purposes of discriminating between explosions and earthquakes becomes more difficult at low yields than at high yield because the ratio of signal-to-background noise becomes low and because the frequency of occurrence of earthquakes and other nonexplosive sources become high. Much of the laboratory and field research on the improvement of our discrimination capabilities is based upon the use of higher frequencies, from 5 to 50 Hertz, on the basis of observations that explosive sources are richer in higher frequencies than earthquakes and of a hypothesis that under surface geologic conditions of low scattering and attenuation discrimination can be accomplished on the basis of differences in the frequency spectra of the two types of sources. Use of the higher frequencies should also allow better resolution of time differences between the arrivals of different seismic phases and hence better determination of depths, durations and other source parameters.

Determination of how best to record, detect and analyze the higher frequency components of the limitations upon their usefulness requires extensive research. Work on many different aspects of the problem is being conducted at the Livermore, Los Alamos and Sandia National Laboratories. These programs include R&D on new field equipment for the recording and detection of the higher frequencies, studies of high frequency propagation in the field, and laboratory research on computer analyses of complex high frequency signals.

Some DOE programs are conducted in cooperation with DARPA, especially those involving expensive field work, and all are coordinated with DARPA and other interested agencies. Funding for this research is approximately $3.0 million in fiscal year 1987 and fiscal year 1988.

BILATERAL MORATORIUM ON NUCLEAR TESTING

Senator KENNEDY. If the U.S. were to enter into a time-limited bilateral moratorium on nuclear testing along the lines of the Aspin-Gephardt-Schroeder amendment the House adopted last August, would the Department require additional funds to support verification of the testing limitations imposed by this legislation? Please outline the specific verification activities that would be needed to implement such legislation and provide an estimate of their cost.

Mr. FOLEY. The Aspin-Gephardt-Schroeder amendment incorrectly assumes that we can, not only determine that seismic signals are nuclear explosions in origin, but also determine their yields accurately enough to verify compliance with a one kiloton limit. This is simply not the case with currently available seismic means. We have repeatedly called attention to the uncertainties in verifying compliance with today's 150 kiloton threshold, uncertainties that would be vastly greater at lower thresholds and perhaps insurmountable at the one kiloton level.

The amendment would require measurement of the yield of Soviet Nuclear explosions on their test site. It also requires verification that no Soviet nuclear explosions are conducted outside designated test areas. This would require monitoring the entire Soviet Union, not just existing test sites and areas which we suspect are capable of decoupling explosions of one kiloton. The amendment makes no provisions for onsite inspections which are necessary for distinguishing between covert nuclear tests and natural seismic activity or chemical explosions. We would also need to determine that the geologic medium in which Soviet tests are conducted at their test sites is indeed strong coupling rock.

Preliminary studies have shown detection and identification, not yield determination, of one kiloton explosions within the Soviet Union would require 30 high performance seismic arrays. Even with this system in place there would still be some small unidentified seismic events. We do not have estimates of the costs of site survey and selection, installation and operation of such a system but estimate that fabrication costs alone would be $200 million and that the arrays could not be in place before 1993. Costs for onsite inspections and verification of the geology in which Soviet tests are conducted cannot be made with information available at this time, but are significant.

DEPLOYABLE SEISMIC TEST NETWORK

Senator KENNEDY. What is the status and funding for the Deployable Seismic Test Network? When will this network become operational?

Mr. FOLEY. I assume the network you are referring to is the Deployable Seismic Verification System (DSVS). The objective of the DSVS program is to provide the U.S. with state-of-the-art seismic equipment for in-country seismic verification. The current funding profile for DSVS is $1.3M in fiscal year 1987, $1.5M in fiscal year 1988, and $9.2M in fiscal year 1989. Design and initial component fabrication for the DSVS began in fiscal year 1986. With the current funding profile, the first station will be available for deployment in early fiscal year 1990 and four additional stations will be available at the end of fiscal year 1990.

NUCLEAR DRIVEN DIRECTED ENERGY WEAPONS

Senator KENNEDY. What is the current status and funding of the x-ray laser program? Please summarize the results of the most recent nuclear explosive tests conducted in support of this program.

Mr. FOLEY. Status of x-ray laser fundings:

	1986	1987	1988 (est.)
LLNL	[Deleted]	[Deleted]	[Deleted]
Sandia	[Deleted]	[Deleted]	[Deleted]

[Deleted.]

TEST TO EXPLORE NDEW

Senator KENNEDY. Have there been nuclear tests at NTS to explore NDEW concepts other than the x-ray laser?

Mr. FOLEY. Yes, there have been nuclear tests at NTS to explore the other NDEW concepts. The table below lists these past tests:

Fiscal year	Test	NDEW concept
[Deleted.]		

"THIRD GENERATION" WEAPONS

Senator KENNEDY. Is it true that to fully develop "third generation" weapons it will be necessary to test them in space and/or the atmosphere?

Mr. FOLEY. No, space and/or atmospheric tests would not be required should the decision ever be made to develop so-called third generation weapons. Anticipated nuclear yields for nuclear directed energy weapons are such that these devices can be tested underground within the current 150 kiloton threshold. To demonstrate certain weapon characteristics and to better understand weapon lethality, use of vertical lines-of-sight or horizontal tunnels may be required; however, like all presently conducted underground tests, the nuclear explosion will take place underground and will be fully contained.

A critical element for any defensive weapon is acquisition, tracking, and pointing (ATP). ATP components for nuclear directed energy weapons can be tested using simulated targets and low-energy beams.

Senator KENNEDY. How many of the tests scheduled for fiscal year 1987 and fiscal year 1988 are related to SDI either as a primary or secondary purpose?

Mr. FOLEY. [Deleted.]

PERFECTING NDEW CONCEPTS

Senator KENNEDY. Dr. Robert W. Selden of the Los Alamos National Laboratory is quoted in the New York Times (April 21, 1986) as saying that it would take 100 to 200 nuclear explosions to perfect just one of the NDEW concepts. By implication this would mean 500 to 1000 explosions for the five currently under study: x-ray laser, hypervelocity pellet, directed microwave, particle beam and optical laser. Do

you concur with Dr. Selden's estimate and if not what number do you foresee will be needed to perfect the concepts.

Mr. FOLEY. First, we believe Dr. Selden was quoted out of context, and your extrapolation is much too high. There is no intent to increase the number of our tests above the present level [deleted] and we do intend to pursue a vigorous research program to achieve the President's SDI objectives.

Most SDI research concerns nonnuclear technologies, in accordance with the President's goal of eventual nonnuclear defenses. However, we are also exploring concepts which would use nuclear energy to power devices that could destory ballistic missiles and warheads at great distances. This work is necessary to understand the potential impact that similar systems which an adversary might develop could have on our retaliatory deterrent or a future defensive system. In addition, the research is being conducted to determine the feasibility of these concepts for future SDI options.

RELATIVE U.S.-SOVIET STANDING IN NUCLEAR WARHEAD TECHNOLOGY

Senator KENNEDY. Would you agree that in the absence of nuclear testing, significant qualitative improvements in the state of nuclear warhead technology are impossible?

Mr. FOLEY. Technology is very difficult to predict. While there may emerge significant advances in theoretical or conceptual designs, we believe that significant qualitative improvements in the design of actual advanced nuclear devices would seem to be very unlikely with a comprehensive test ban (CTB). Our current design process relies on the scientific method, which iterates theory and experiment toward determining the true performance characteristics of a weapon, a very complex physical system. We believe that the [deleted] process which determine the performance of a nuclear device must today, and in the foreseeable future, rely on testing for significant advances.

It is important to recognize that in the past, as in the moratorium period, pressures for qualitative improvements become very great, but mistakes were made that either reduced confidence in the weapons involved or led to false and unjustified confidence.

This answer should not be construed as meaning that arms modernization would cease, nor that technological stability would be assured. New delivery systems would be probable, and nuclear warheads for ABM or counter-defense could be developed based on past nuclear tests. They would be significantly off optimum, thereby increasing the systems expense.

Again, one of the most serious problems with a long-term testing restriction is maintaining people with the expertise and experience to judge whether a change would be a significant improvement or a disaster. Their judgment today is based solidly on the experience they have gained from the ongoing nuclear test program.

We do not agree that zero-yield tests can confirm the reliability of a stockpiled weapon under a comprehensive test ban. They provide valuable information on the earliest nonnuclear steps in the operation of a primary. However, by definition, they cannot address any of the crucial steps involved with nuclear energy production. They cannot be used for studies of primary boosting, energy coupling to the secondary, or secondary explosion. These phases, which can only be studied in an Nevada Test Site nuclear test, are predominantly crucial to the reliability of a weapon. Thus, zero-yield tests alone emphatically cannot confirm weapon reliability.

Senator KENNEDY. Page 10 of the fiscal year 1988 JCS Posture Statement contains a table of the relative U.S.-Soviet Standing in the twenty most important basic technology areas. This table shows equality in nuclear warheads but that the level is "changing significantly" in the Soviets favor—a change from the same table in the fiscal year 1987 issue. What information have you gained in the past year that caused this reassessment?

Mr. FOLEY. [Deleted.]

SOVIET NUCLEAR TECHNOLOGY

Senator KENNEDY. In what specific areas are the Soviets making advances in nuclear technology that would lead to this assessment? How much do we know about Soviet nuclear warhead technology?

Mr. FOLEY. [Deleted.]

[Whereupon at 2:46 p.m., the subcommittee recessed, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

FRIDAY, MARCH 6, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

STRATEGIC WARNING CAPABILITIES AND ICBM MODERNIZATION PROGRAM

The subcommittee met in open session, pursuant to notice, at 10:30 a.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Levin, Gore, Warner, Thurmond, and Wilson.

Staff present: Robert F. Bott, William E. Hoehn, Jr., and Ronald P. Kelly, professional staff members; Colleen M. Getz, research assistant; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Milton D. Beach and Donald A. Mitchell, assistants to Senator Glenn; Leon Fuerth, assistant to Senator Gore; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order again.

We are now in open session, and we are pleased to have the two witnesses that we will now proceed with, General May and Dr. Woodruff.

I would ask you gentlemen to proceed in any fashion that you wish at this time. I don't know whether you have decided among yourselves who should testify first.

Do we start with Dr. Woodruff?

Dr. WOODRUFF. Yes. That would be fine.

Senator EXON. We are very glad to have you with us, Dr. Woodruff.

Senator THURMOND. Mr. Chairman, may I place my opening statement in the record?

Senator EXON. Yes, without objection.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT OF SENATOR STROM THURMOND

Thank you Mr. Chairman.

I join with you in welcoming our witnesses this morning.

ICBM modernization promises to be a most important issue for the committee again this year. The President has kept faith with the Congress in approving an ICBM modernization roadmap that implements the ICBM portion of the Scowcroft Report. He has proposed to develop a survivable basing mode for the Peacekeeper missile that shows much promise, and has continued his commitment to the Small ICBM by initiating full scale development.

It is worth noting, Mr. Chairman, that in accordance with the FY 1987 Defense Authorization Bill, the linkage in law between the Small ICBM program and the schedule of deployment for the fifty Peacekeeper missiles in existing silos is repealed with the start of Small ICBM full scale development. This will allow the Congress to focus on what is the real issue, and that is how to modernize the ICBM leg of the triad in a manner that is both survivable and affordable.

Mr. Chairman, I think all members of the committee will be taking a hard look at the ICBM modernization roadmap that is before us. There are important issues to consider, one of which is the dependence on warning that we took up earlier this morning. As I indicated last year, Mr. Chairman, I continue to be concerned about the costs, particularly the life cycle of the Small ICBM, in view of our other strategic and conventional force priorities.

Dr. Woodruff and General May, I congratulate the Department of Defense and the Department of the Air Force on the superb job you are doing in conducting a flawless Peacekeeper flight test program and in meeting the schedule for initial Peacekeeper deployment. General May, I know a lot of that credit goes to the Ballistic Missile Office and to the Strategic Air Command, and I ask that you convey my congratulations to them.

Thank you Mr. Chairman. I look forward to the testimony of this panel, which should provide us the program details that we will need in the coming weeks to make our recommendations on the defense budget.

Senator EXON. Dr. Woodruff, please proceed.

STATEMENT OF HON. LARRY WOODRUFF, DEPUTY UNDER SECRETARY OF DEFENSE (STRATEGIC AND THEATER NUCLEAR FORCES)

Dr. WOODRUFF. Let me suggest that we proceed in the following way.

I would like to give just a few comments to briefly describe the decisions that were made in December on the ICBM programs.

Senator EXON. Yes, we are very interested in that.

Dr. WOODRUFF. That will be for background information. I will describe the systems briefly, go through the cost schedule, survivability, and then I will turn to General May to discuss some of the programmatic aspects of what is going to happen next.

Senator EXON. Very good.

Dr. WOODRUFF. The first slide please.

PRESIDENT'S PROGRAM FOR CONTINUED ICBM MODERNIZATION

Single warhead, 37,000 lb. small ICBM.

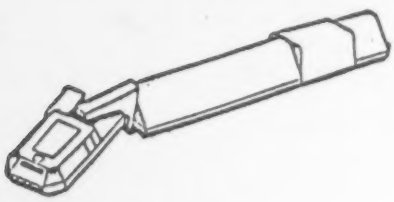
Small ICBM on hard mobile launchers deployed initially on existing Minuteman ICBM sites.

Rail garrison basing for Peacekeeper.

As you already know, there were three decisions made. One was to begin full-scale development on the small ICBM single warhead, 37,000 pounds; to deploy it in hard-mobile launchers, initially on Minuteman sites; and then to begin development, which we have, on the Peacekeeper rail-garrison system.

I am going to go back and explain each of these.

SMALL ICBM DECISION



- ENTER FULL-SCALE DEVELOPMENT IN FY87
  - SINGLE RV, 37,000 LB WEIGHT MISSILE
  - INITIAL DEPLOYMENT IN HML ON MINUTEMAN SITES
  - RETAIN CAPABILITY FOR RANDOM MOVEMENT ON DOD LAND
- ATTRIBUTES
  - SINGLE RV PROVIDES TARGETING AND DEPLOYMENT FLEXIBILITY, AND EARLIEST IOC
  - 37,000 LB WEIGHT ACCOMMODATES PENETRATION AIDS
  - SYSTEM CAN BE DISPERSED ON TACTICAL OR STRATEGIC WARNING
  - PROVIDES RESPONSIVE RETALIATION AND POST STRIKE RESERVE FORCE

Let me briefly describe the small ICBM decision.

I give credit to the Air Force. They did a tremendous amount of work last year, looking at different configurations for the missile and the basing, trying to find the lowest cost small missile.

The one thing they really studied were multiple RV small missiles. They, in fact, found out that a 2 RV small missile was doable and less expensive. Cost savings were on the order of 10 to 15 percent.

On the other hand, they also found out that they would delay the initial operational capability of that missile by about 2 years. There would be some degradation in survivability or mobility because of the weight of that missile. Those factors, plus the fact that a single RV missile gives greater flexibility, particularly in a post-attack environment, led the Air Force and then the Secretary to recommend to the President that we stay with the single RV missile.

We did increase its size. We added some to the first stage, giving it a total weight of 37,000 pounds.

We could accommodate that within the schedule. But, it also allowed us the ability to add penetration aids some time in the future, if need be.

It made sense and was logical.

Now, the deployment options—the Air Force looked at a number of deployment options for the hard-mobile launchers and narrowed it down to two: putting them on Minuteman sites or deploying them in a random movement mode on large bases in the Southwest.

For cost reasons, the Air Force elected to start on the Minuteman sites. That means that we would have the Small Missiles and their launchers sitting at various Minuteman missile silo sites.

Within minutes of a decision, they would, of course, flush off, that is, disperse off those sites, and generate large areas of dispersal. The Soviets would probably have to barrage those areas. Those areas would be so large that they could not do it, and the missile would be survivable.

Later I am going to show a chart on area versus time for this system, so that you can understand what the mobility-survivability implications are.

People raised a threat against this kind of basing mode. That threat, simply, is that the Soviets would move submarines in close to the coast, develop depressed trajectory missiles, reentry systems, target those Minuteman sites, and get those small missiles before they move very far.

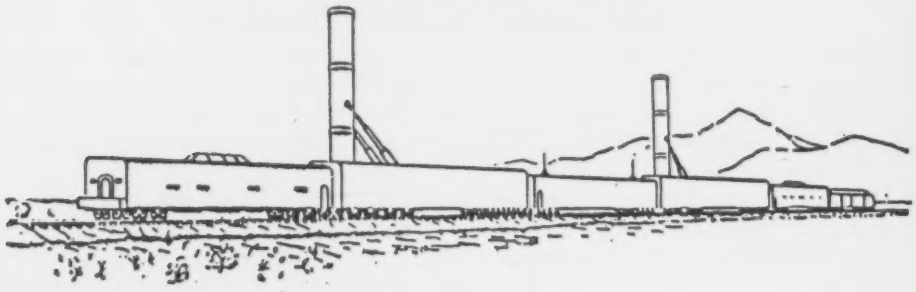
The Air Force's response to that is to carry the option for dispersing this missile, basing it in the Southwest on these large bases. They would be moving in a random movement mode so the Soviet submarine or targeteer would not know where they were and could not target them. Therefore, they would be survivable.

All of these systems that I will discuss, both Peacekeeper and the Small Missile, have a very robust command and control system. Just like the Minuteman system, they can all be launched within minutes. That is true whether the Small Missile is sitting on the Minuteman site, on the random movement mode, or dispersed out in the field.

Concerning the last point on the chart, post-strike reserve force—the Air Force has made a good case that the Small Missile makes sense, particularly in the post-strike, post-SIOP world, where there is a limited number of targets that we might want to hold at risk. That single RV missile gives that flexibility.

I will come back to that point.

PEACEKEEPER DECISION



- BEGIN RAIL GARRISON R&D IN FY87
  - GARRISON ON EXISTING STRATEGIC AIR COMMAND BASES
  - 2 MISSILES PER TRAIN
  - 2-4 TRAINS PER GARRISON

- ATTRIBUTES
  - HOLDS HARDEST SOVIET NUCLEAR FORCES AT RISK AT LOWEST COST
  - EASILY RESPONSIVE (DAILY) TO THREAT INDICATORS
  - PROVIDES RESPONSIVE RETALIATION CAPABILITY

Now, the concept of the rail-garrison option that was proposed, which I think you have heard described before—and this will evolve over time because we are really studying and developing it this year—is to put Peacekeeper on trains. Initially we are thinking of two missiles per train; two to four trains per garrison; placing those garrisons on SAC bases to reduce costs; and then on national need or the indicators that General Doyle talked about, dispersing those trains off base.

I will show you in the next chart what that means.

Senator EXON. Let me interrupt you right there.

You said to put these on SAC bases. Is there any reason that they could not be on any bases that we have?

Dr. WOODRUFF. General May can speak to that, but I think the main reason is to use the infrastructure that exists on those bases for missiles and operations, thereby reducing costs. But there is no reason why you couldn't put it in other places, and just pay for it.

General MAY. That is exactly right, sir.

In our initial look, it seemed to us that the most cost-effective way to base this system would be to use the existing infrastructure on SAC missile and bomber bases. And so, our initial down-select to the 11 bases that we are looking primarily at SAC facilities.

However, there is no reason that you couldn't put them on other bases. In many cases, it would probably be a more costly bed-down, primarily because many of our other bases don't have the nuclear weapons facilities and so forth to support rail garrison.

Senator EXON. I see.

I'm sorry to interrupt you.

Go ahead.

Dr. WOODRUFF. I want to say that the Air Force did a tremendous job in this area. They looked at a lot of survivable basing options for Peacekeeper and they narrowed it down to four. Then, finally, primarily because of the low cost of this system, they did select and recommend and we went forward with the rail-garrison concept.

After you heard General Doyle this morning, you can get a feeling of the flexibility of this system. As levels of indicators creep up, this system is very flexible. You can disperse part of it, all of it, part of the time, all of the time, depending on the threat situation.

Last, as with the Small Missile, it can be launched within minutes. The Soviets have to face that whether it is in the rail garrison, being dispersed, or out on the rail somewhere.

ICBM MODERNIZATION

(PRELIMINARY)

	PEACEKEEPER in RAIL GARRISON	SMALL MISSILE (37K LB/1RV) in HARD MOBILE LAUNCHER
ACQUISITION COST *	$10-12B	$37-39B
LIFE-CYCLE COST *	$13-15B	$44-48B
IOC	1991	1992
MANPOWER	2,400	5,300-8,600

* FY88 Dollars for 500 Deployed RVs

The cost issue is something everyone keeps talking about. These are the preliminary costs that the Air Force has come forward with on these two concepts.

Again, I want to say that we are early in the development of both concepts, particularly the rail garrison. But you can see the life cycle costs, and that is for about a 15-year life cycle. We have assumed for this that there are 500 warheads deployed on each system, and that decision has not been made yet either.

But on that basis, the costs are about $13 billion to $15 billion for the rail garrison and in the neighborhood of $44 billion to $48 billion for the Small Missile.

You can look at the availability dates and the manpower and can compare the two systems.

Senator EXON. You are talking about both systems, and you are talking about the cost. When you talk about $10 billion to $12 billion for the Peacekeeper and the rail garrison, how many warheads is that?

Dr. WOODRUFF. This assumes 500 warheads, so it would be 50 Peacekeeper missiles.

Senator EXON. Sixty missiles?

Dr. WOODRUFF. Fifty missiles.

Senator EXON. OK, that's 50 in addition to the 50 we have already approved. Is that right?

Mr. WOODRUFF. Yes.

Senator EXON. Then the Small Missile in the hard-mobile launcher, that figure is $37 billion for what?

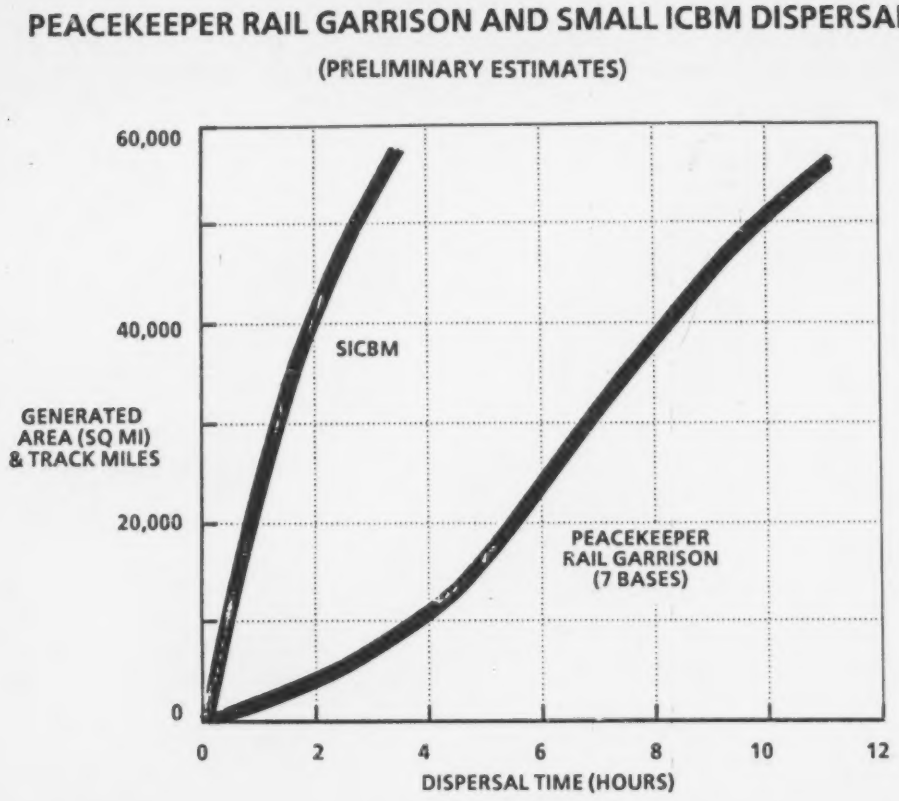
Dr. WOODRUFF. The life cycle cost is $44 billion to $48 billion. Acquisition cost is $37 billion to $39 billion—that is as well as we know it.

Senator EXON. So, it is three times as expensive, basically?

Dr. WOODRUFF. Yes.

Senator EXON. Go ahead. You have not finished your prepared statement.

Dr. WOODRUFF. That is cost and schedule summary. Next, I should talk about the survivability and dispersal capabilities of the two systems.



This, again, is our first cut at the survivability or dispersal capability of the two systems.

Plotted on the left is either the square miles that the Small Missile can achieve or generate, as a function of time, or track miles that the rail-garrison Peacekeeper can achieve as a function of time.

The points to emphasize on the chart are that the Small Missile moves out much quicker. Within about 30 minutes it is out to almost 20,000 square miles of area.

The rail garrison, on the other hand, is a little slower, and in 4 or 5 hours, it is out to about the same area.

Now, these curves continue to go on. For example, the rail garrison, in theory, could access almost all the rail network, which is on the order of 150,000 to 200,000 miles of track.

Survivability—and in an open hearing, I cannot really go into detail—let me try to give you a rough idea.

If the Soviets took their whole arsenal of ICBMs and tried to barrage either this area or the number of track miles, one or the other, they would be laying down a barrage that would cover something in this area somewhere (indicating).

The point is that in a few hours we have gone out into areas that are unattackable for either system by the Soviets.

THE SOVIET ATTACK PLANNER DILEMMA

Soviet nuclear attack would be preceded by a deliberate decision providing indicators.

On any of these indicators, U.S. can:

Place most of the bombers on alert.

Increase ballistic missile submarines at sea.

Disperse Peacekeepers and small ICBMs.

Day to day posture provides insurance against the unlikely case of no indicators.

Two-thirds of ballistic missile submarines always at sea.

One-third of bomber force can launch on tactical warning.

Small ICBM can dash for survivability on tactical warning.

ICBMs can launch within minutes of decision.

The last chart simply speaks to deterrent value and how these two systems play together.

Imagine yourself as a Soviet attack planner. In the more likely case, you are going to go to war only after configuring your own forces, providing indicators that General Doyle talked about this morning.

In that situation, you are going to be faced with most of our bombers on alert, most of our submarines at sea, and I would assume all of the mobile Peacekeepers and Small Missiles dispersed.

In the very unlikely case that you try to go to war without generating your forces, making you more vulnerable, providing no indicators, the Soviet attack planner is still faced with the things on the bottom of the chart—two-thirds of the ballistic missiles at sea, one-third of our bombers on alert, Small Missiles now can dash and survive in that situation, and, of course, you are still faced with the possibility that we could launch all of our ICBMs within minutes.

So I think it is a very robust and credible deterrent.

If you would like, we can turn next to General May.

Senator EXON. Before we go to General May, would you flash up again the second or third chart you had, with the picture of the Peacekeeper and the rail system.

There are six rail cars. Can you explain to us what the makeup of the train is? Two of them are carrying Peacekeepers, I presume.

Dr. WOODRUFF. That is correct. The others are in support of it. Charlie, do you want to describe it, please.

General MAY. Yes, sir. I will do it now, if you like. I have a slide to cover this in my briefing also.

Senator EXON. Well, then, let me withhold my question. Please go ahead with your presentation. If you will cover it there——

General MAY. Yes, sir. I will.

Senator EXON [continuing]. We don't need to go into it now.

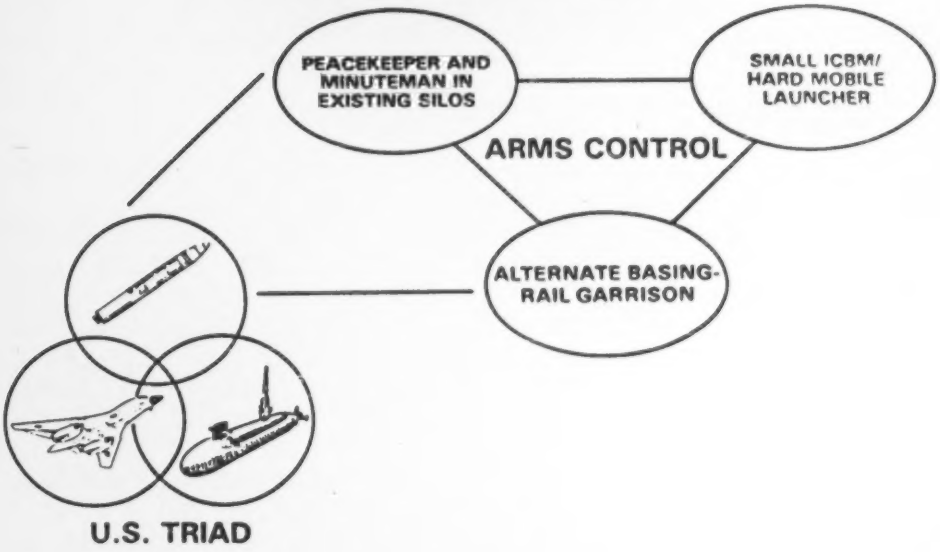
General MAY. Fine. Thank you.

STATEMENT OF BRIG. GEN. CHARLES A. MAY, USAF, SPECIAL ASSISTANT FOR ICBM MODERNIZATION, HQ, USAF

General MAY. In order to use the microphone, Senator Exon, I will remain at my seat, rather than stand, to give my briefing.

Once again, sir, it is a pleasure to be here this morning. ICBM modernization will be my topic.

PRESIDENT'S PROGRAM FOR CONTINUED ICBM MODERNIZATION



What we try to depict on this slide are the three parts of ICBM modernization today. We are continuing to implement the strategy that was first laid down by the Scowcroft Commission in 1983. We are continuing to work the silo problem with, primarily, Minuteman IIs and IIIs, on which we are working. I will show you our budget request to continue that modernization effort.

As you know, we are deploying Peacekeeper missiles in Minuteman silos today at Warren Air Force Base.

As Dr. Woodruff mentioned, we have entered into two new programs, a small ICBM, in accordance with the Scowcroft Commission results, which the administration and the Congress accepted. Also, we have come back to the Congress in response to the opportunity presented in the 1986 authorization process, to seek a more survivable, mobile, concealable, basing mode for our Peacekeeper missiles.

I will cover each one of these programs in some detail.

This is where we stand on our Peacekeeper program today. The Congress has authorized and appropriated money for 66 missiles. Fifty of those missiles we plan to deploy in Minuteman silos; the other 16 will be used as part of our operational test and evaluation program throughout the life of the missile.

We plan for a 15-year life cycle, but, based on experience, we believe firmly that we will have Peacekeepers around for much longer than that in a nonarms control environment.

We have completed 16 of our 20 RDT&E flights, and, by far, it has been the most successful missile development program that the United States Air Force has ever undertaken.

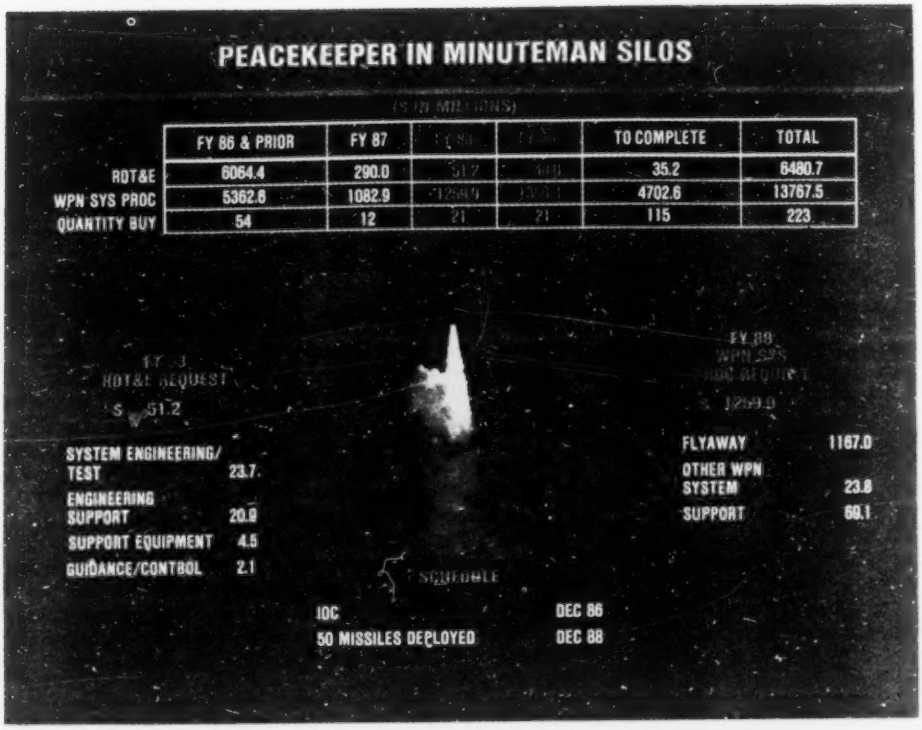
We have had 16 very, very successful flights, and we have been able to demonstrate reliability and accuracy far superior to the specifications that we laid down. We are very excited about this particular aspect of the Peacekeeper program.

We completed ahead of schedule, thanks to two winters of excellent weather at Warren Air Force Base, all of the construction activity on base, and we have completed construction on 14 of the 50 silos in which we will deploy our Peacekeeper missiles.

Finally, we reached our IOC in December 1986, with 10 missiles deployed, and we are very confident that we will be able to reach our FDC in December 1988, at which time we will have the full 50 deployed in silos.

Senator EXON. What year is that?

General MAY. December 1988, sir.



This is our budget request for fiscal year 1988. First of all, I will comment on the $51.2 million in the first row to complete the RDT&E program. We have been funded at the 99 percent level, and the remaining funds are essentially to wrap up the R&D program in terms of taking the test data from the research and development program that we will complete, as far as firing is concerned, sometime this summer and reducing it into useful form.

The procurement of 21 missiles in each year are missiles designed to go into our inventory for use primarily in the test program.

As you know, the Congress has only appropriated enough money for 21 missiles in 1 year, and 21 is actually our minimum economic buy rate.

We plan to buy at the rate of 48. Twenty-one is our minimum economic rate. However, we can purchase at the level of 12, which has been the authorization that we have received from the Congress the last 2 years.

PRESIDENT'S PROGRAM FOR CONTINUED ICBM MODERNIZATION

ISSUES

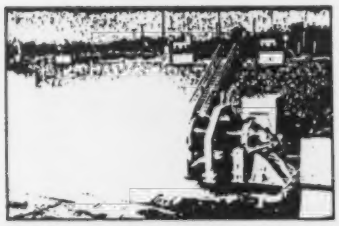
- SMALL ICBM CONFIGURATION
- SMALL ICBM BASING
- MORE SURVIVABLE BASING FOR PEACEKEEPER

SOLUTIONS

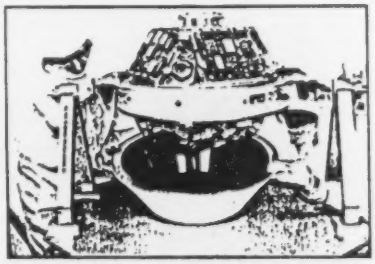
- SINGLE WARHEAD 37,000-LB SMALL ICBM
- SMALL ICBM ON HARD MOBILE LAUNCHERS DEPLOYED ON EXISTING MINUTEMAN ICBM SITES
- RAIL GARRISON BASING FOR PEACEKEEPER

General MAY. Dr. Woodruff covered the President's decisions, and I will just flip on to the next slide.

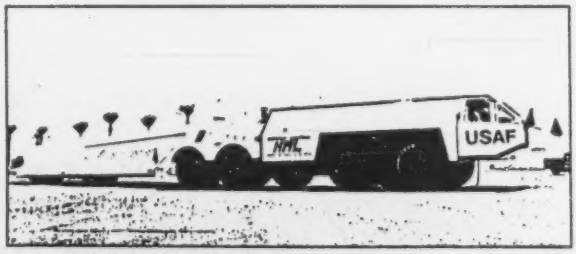
SMALL ICBM PROGRAM STATUS



- HIGH-ENERGY PROPELLANTS AND LIGHTWEIGHT HIGH-STRENGTH MOTOR CASES DEMONSTRATED



- BASELINE MOD AIRS AND ALTERNATIVE GUIDANCE SYSTEMS IN TESTING



- HARD MOBILE LAUNCHER MOBILITY AND HARDNESS DEMONSTRATED

- BRICKBAT 01 PRIORITY
- CANDIDATE DEPLOYMENT SITES SELECTED
- FSD CONTRACTS AWARDED
- PROGRAM ON SCHEDULE FOR 1992 IOC

General MAY. The small missile program has been ongoing now for 3 years, and perhaps is the most aggressive, competitive, and

successful pre-full-scale demonstration validation program that the Air Force has ever undertaken.

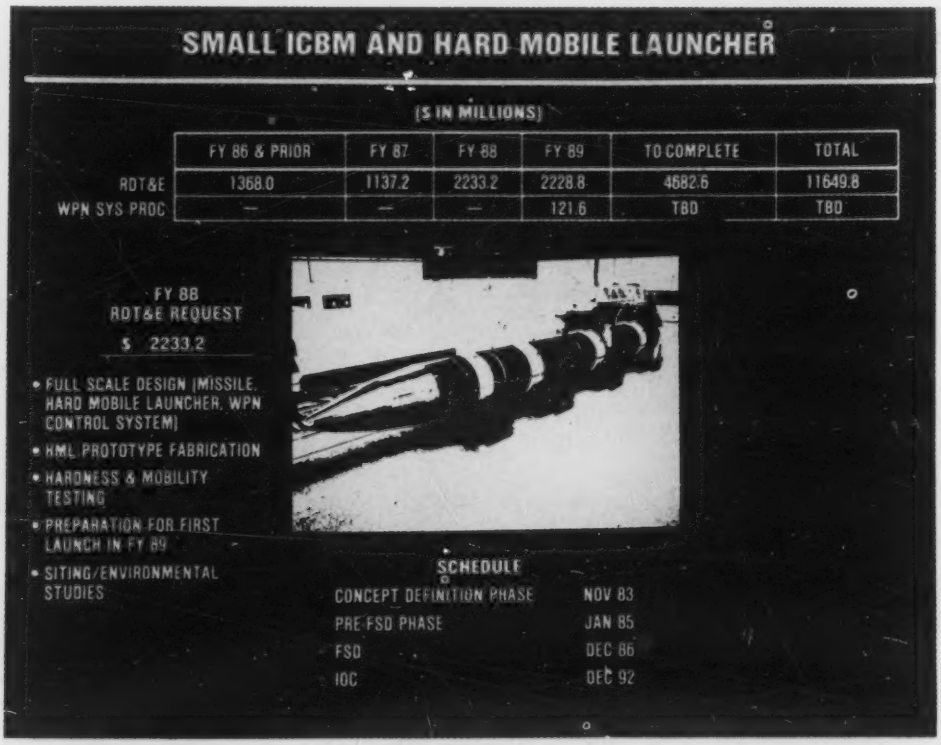
We hope to go from concept definition to initial operational capability in 9 years, compared to the 14 years that it took us to deploy the Peacekeeper missile.

So, it is a very aggressive program, and we had great success in a very competitive environment.

During this year, we selected the three contractors to build the three stages after each of them had gone through a number of test firings of prototype developments for the stages on the missile. We have continued our alternate inertial navigation system competition. We down-selected from three competitors to two, and we will begin flying those competitors this month.

For the baseline system, however, in order to meet our IOC of 1992, we will have to use the inertial navigation system, the so-called AIRS, that we use on Peacekeeper for at least the first 100 missiles.

Finally, we had a very intense competition between Boeing and Martin Marietta to develop the hard-mobile launcher, and we selected Boeing in December of this year as the winner of that contract. In fact, to date, we have selected all 12 of the primary contractors to conduct our full-scale engineering and development program.

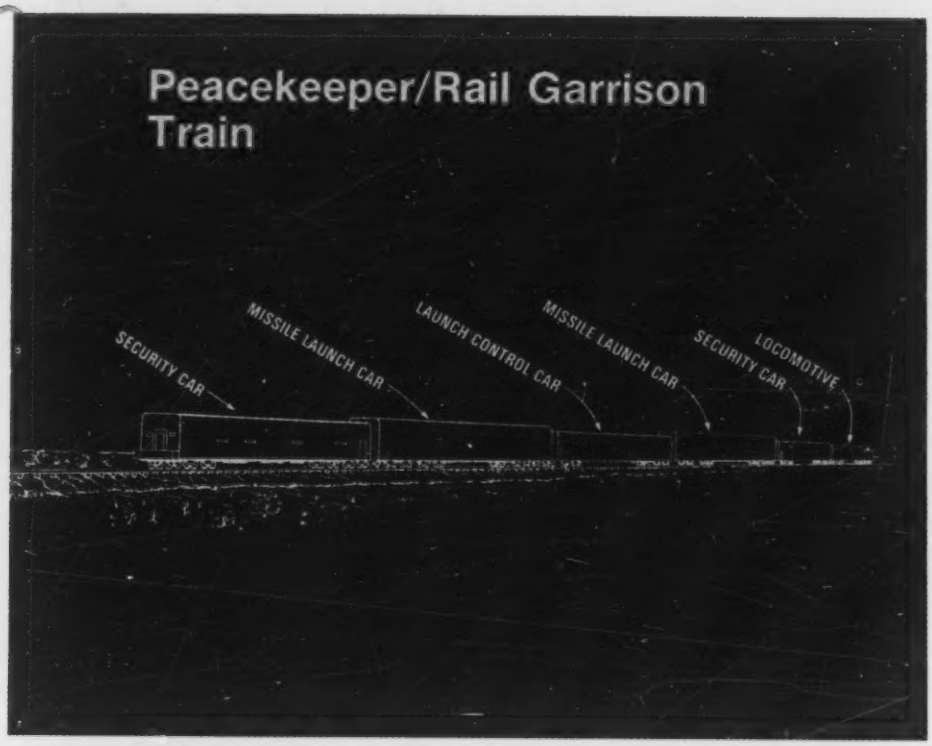


In order to continue that aggressive program, we are asking the Congress to fund essentially $2.2 billion in 1988 and $2.2 billion in 1989.

What we are going to do with that money is laid out in the left-hand column. Primarily, we are going to begin developing the prototypes, leading to the first test firing of a small missile in fiscal year 1989.

To date, we have been funded at the $2.5 billion level, and we are asking for slightly less than $4 billion in the next 2 years to continue this aggressive, full-scale engineering and development program.

You can see in fiscal year 1989 that we have a little over $100 million for procurement, and this, basically, is to begin the procurement, the long lead-time items necessary for the guidance system and some of the initial test equipment, to begin producing missiles with fiscal year 1990 money.



This is the slide, sir, that I promised you, in the rail garrison, which describes the train.

As you suggested, there are two missile cars. Each one of those cars will have one Peacekeeper missile, with the full complement of 10 RVs.

We will have two security cars to primarily provide security, once the missile is out on the rails in time of national need.

Finally, we will have a launch control car which will contain the two crew members who will have the capability to launch either or both of the Peacekeeper missiles.

Senator EXON. Let me ask you a question right there.

Are those rail cars that hold the two missiles—what is the size of them? Are those about the size of boxcars that are used on the rails today, or are they larger?

General MAY. Sir, our planning today tells us that the physical dimensions, in terms of the basic cube, will be about the size of the rail cars that are used to carry automobiles back and forth. There are cars that are that size.

However, they will be much heavier than those cars. We anticipate today that that car will weigh somewhere around 500,000 to 550,000 pounds.

Senator EXON. As opposed to what for a standard car?

General MAY. Well, the standard freight cars run somewhere between 100,000 and 250,000 pounds. But there are a number of cars on the rails today, in addition to locomotives, which can weigh up to 1,000 tons, that weigh at least as much as 500,000 pounds. There are a number of outsized train vehicles and so forth on the rails today that weigh more than we expect our train to weigh or our car to weigh.

Senator EXON. So, size-wise and weight-wise, we have similar train cars on the rails today?

General MAY. Yes, sir.

Senator EXON. Thank you.

General MAY. The other point I might make about the cars and the locomotive and so forth, we basically expect—and I am not being facetious when I say that we will go to the train builders' or the train buyers' catalogues and purchase the cars that we need, with the exception of the missile car itself—that the missile car, although many of the components will be out of the catalogue, we obviously will have to do some additional work in order to install the launcher and make it capable of carrying and launching the Peacekeeper missile.

But, fundamentally, we believe that this is a low-to-moderate risk program because we are able to take off-the-shelf equipment and put it together into a Peacekeeper train.

Senator THURMOND. I notice that you have two security cars—one behind the locomotive and one at the very end. What do you have in those cars?

General MAY. Senator Thurmond, we have not decided exactly what we will have in there. We will start out with the requirement to have 15 security personnel available in 5 minutes which is the basic rule that we use to protect all of our nuclear weapons.

So, at a minimum, we will have 15 security personnel on board that train. We think at this point in time that we should have some in front and some in back. Clearly, there will be additional room in those cars to either carry maintenance personnel or to carry logistic support items and so forth.

Senator THURMOND. Now, if you have five cars in all instances, will that be a clue to the Soviets that that is the Peacekeeper train and can thus be identified quickly from some other trains?

General MAY. Sir, one of the challenges that we face in the next year, as we move into the development aspect of this program, is to answer that very question.

We know today that there are in the neighborhood of 1½ million cars out on the railroads at any given time. So, we think, first and foremost, that there is a great big haystack out there, and we are looking to develop the needle that the Soviets have to find. We re-

alize that there could be some signature elements that we have to take into consideration.

Our basic design criteria is to make the cars look as much like the Union Pacific or the Burlington Northern or Amtrak as we possibly can. We don't want to give away the show, so to speak, if we think we could, by only having a six-car train when there are no other six-car trains on the U.S. railroad system.

Senator EXON. Well, you could put a few cattle cars on there and a caboose on the back end and camouflage it in that way, couldn't you? Isn't that a possibility?

Senator THURMOND. That's what I had in mind.

General MAY. Yes, sir.

We think there are plenty of opportunities to do that. The important thing from our point of view also is that the Soviet planner has to understand exactly what we are doing at a given time. So there are numerous opportunities for concealment and deception.

Senator EXON. It is a good question that Senator Thurmond raised.

I guess, then, what you are telling us is that this would be what you think at this time is a minimum requirement for some kind of train that would have Peacekeepers on it.

General MAY. Yes, sir.

Senator EXON. It could be a 40 or 50 car train, if you wanted it to, I suppose, right?

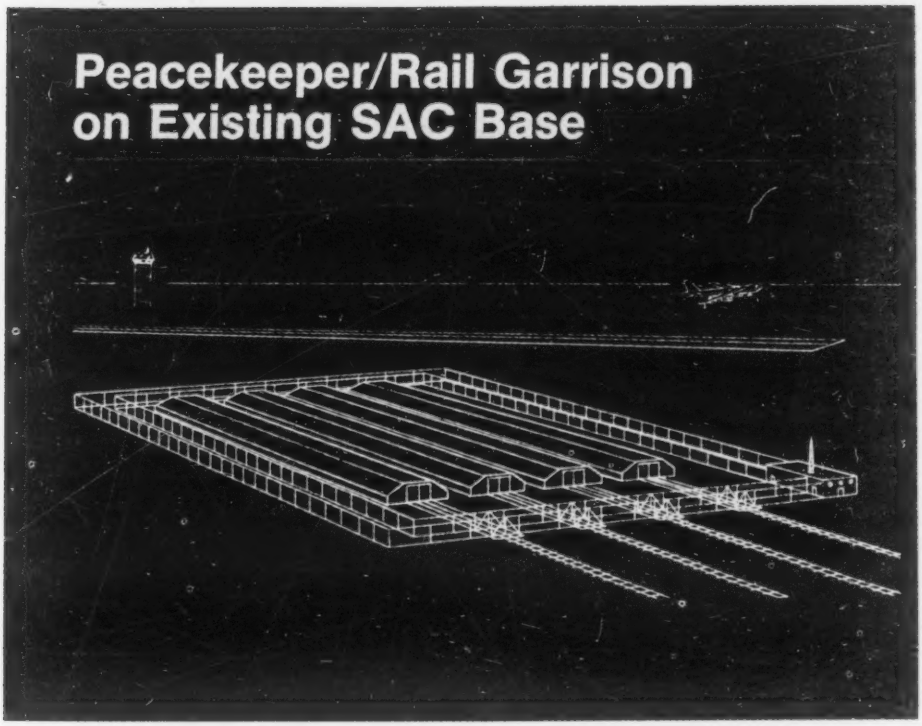
General MAY. It seems to us that that possibility clearly exists. We need to understand better the whole question of position location uncertainty, as we referred to it in the past.

Dr. WOODRUFF. I would make a comment on that.

I see this program evolving for both missile systems the way we do our submarines.

I see us having an SSBN security program for ICBMs, where the Air Force constantly monitors in a Red Team kind of fashion the vulnerabilities that might come up in the future and responds to them ahead of time.

The questions you are asking are right on, and the Air Force is going to work those this year. But I don't think they will solve them instantly. You are going to evolve this thing as time goes on.



General MAY. This particular system is referred to as rail garrison, as opposed to some of the schemes that we have looked at over the years, which were referred to as rail mobile. Of course, the name indicates the obvious distinction. It is our intention, plan, and expectation that we will be able to deal with these trains, in garrison, in essentially the same fashion that we have been able to manage our alert bomber force over the past 30 years.

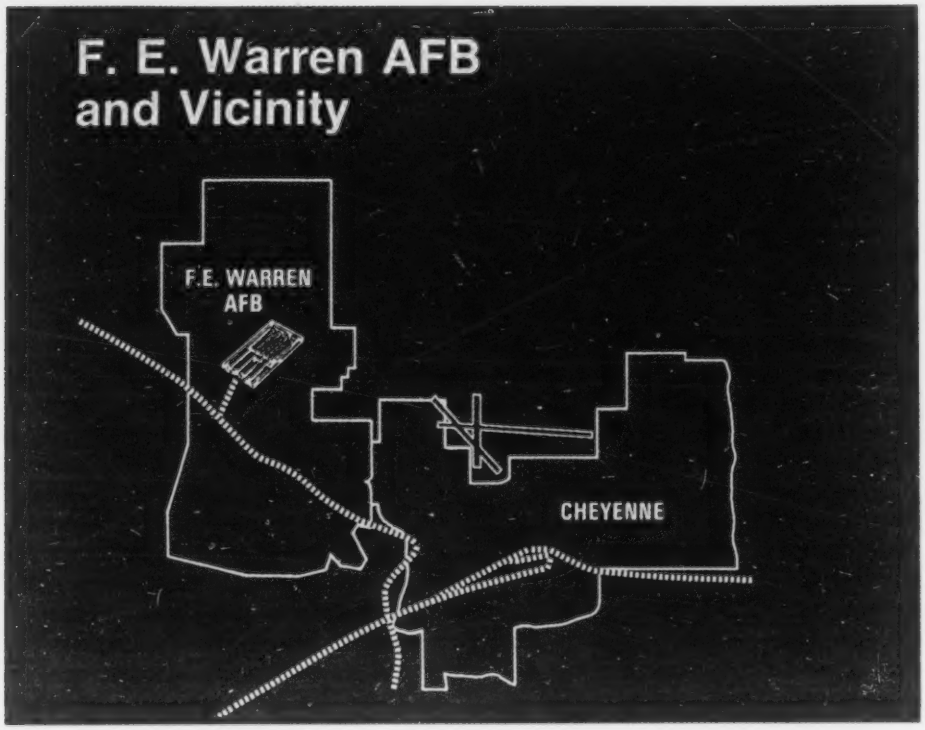
As you know, we have had bombers on alert, and we have never had the occasion to launch those bombers, either in response to an international crisis or response to a terrorist threat to anyone of the numerous orbits. We hope that the trains will be seen by our enemy in the same fashion, in a deterrent fashion, so that those trains will stay in garrison throughout their lifetime, except during time of national need, as determined by the President or his subordinates, as he chooses.

When we talk about garrison, we are talking, as we said before, about Strategic Air Command bases or bases that have a significant SAC mission. We have identified 11 bases as our candidates at this point in time.

We also have indicated that probably each base would have a minimum of two and a maximum of four trains in their garrison. The basic criteria for deciding how many trains to have on each base would be the land area available, the amount of railroad track available, and so forth, as well as the impact on the local community.

Our first base, which we announced on the 19th of December, will be Warren Air Force Base in Wyoming, and the obvious reason

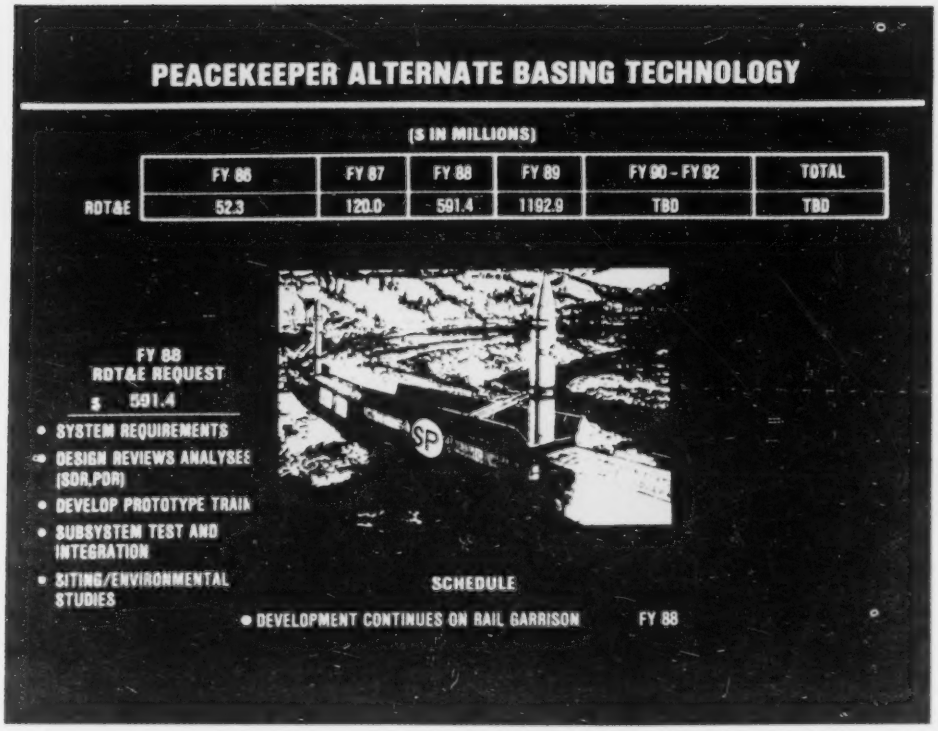
for going there is because our Peacekeeper infrastructure has already been installed there in conjunction with the Minuteman silo basing.



This is just an artist's conception of what the facility might look like at Warren.

I was there earlier this week and flew over the area that they are talking about using for rail garrison, and looked at the transportation system, the railroad network in Cheyenne. I was amazed at the number of permutations and combinations you do get that are not adequately depicted on this slide.

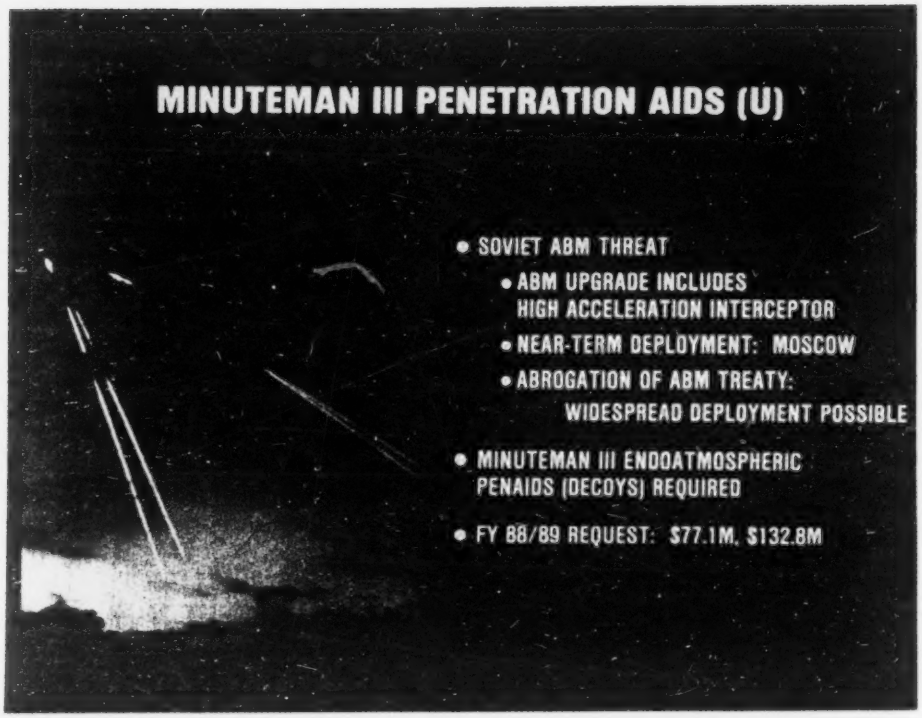
There are just innumerable train movements and there are innumerable opportunities to move a train out of Warren Air Force Base. Each time you come to an intersection, of course, you create a combination for the Soviet planner that he has to deal with in trying to hold at risk this particular strategic system.


PEACEKEEPER ALTERNATE BASING TECHNOLOGY
($ IN MILLIONS)
FY 86 | FY 87 | FY 88 | FY 89 | FY 90 - FY 92 | TOTAL
RDT&E | 52.3 | 120.0 | 591.4 | 1192.9 | TBD | TBD
FY 88 RDT&E REQUEST
$ 591.4
• SYSTEM REQUIREMENTS
• DESIGN REVIEWS ANALYSES (SDR,PDR)
• DEVELOP PROTOTYPE TRAIN
• SUBSYSTEM TEST AND INTEGRATION
• SITING/ENVIRONMENTAL STUDIES
SCHEDULE
• DEVELOPMENT CONTINUES ON RAIL GARRISON FY 88

This slide depicts what we are asking the Congress to authorize in fiscal year 1988 and fiscal year 1989. You can see that we are asking for 3600 money to develop the rail-garrison basing option.

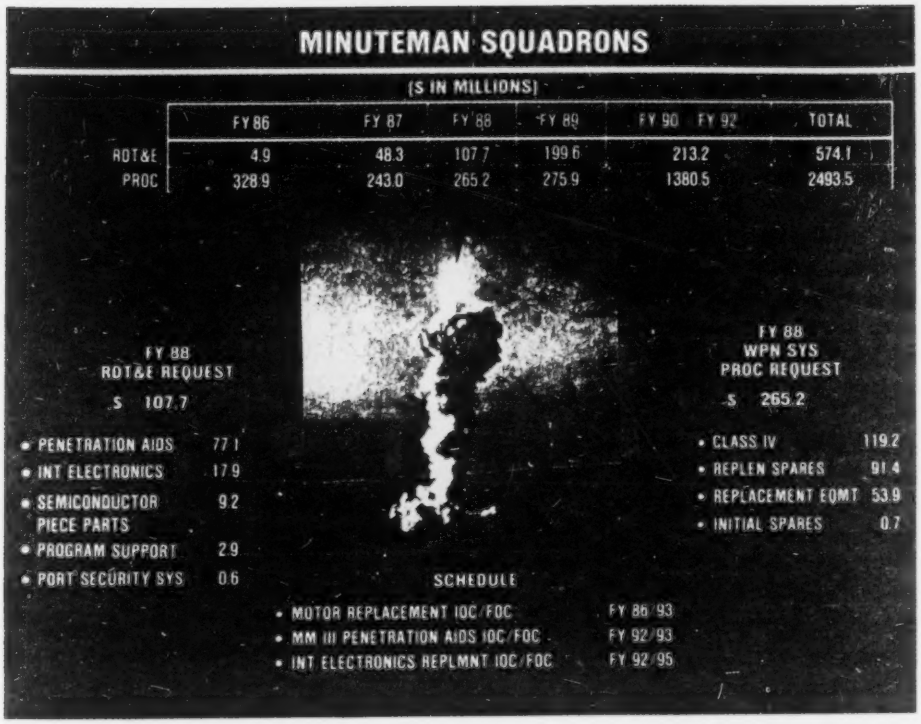
The things that we have to do this year are, essentially, develop the system, begin to do some prototype work, and make sure that we understand all that we need to understand about the rail-garrison basing option.

We are asking for approximately $1.2 billion in fiscal year 1989.


MINUTEMAN III PENETRATION AIDS (U)
• SOVIET ABM THREAT
• ABM UPGRADE INCLUDES HIGH ACCELERATION INTERCEPTOR
• NEAR-TERM DEPLOYMENT: MOSCOW
• ABROGATION OF ABM TREATY: WIDESPREAD DEPLOYMENT POSSIBLE
• MINUTEMAN III ENDOATMOSPHERIC PENAIDS (DECOYS) REQUIRED
• FY 88/89 REQUEST: $77.1M, $132.8M

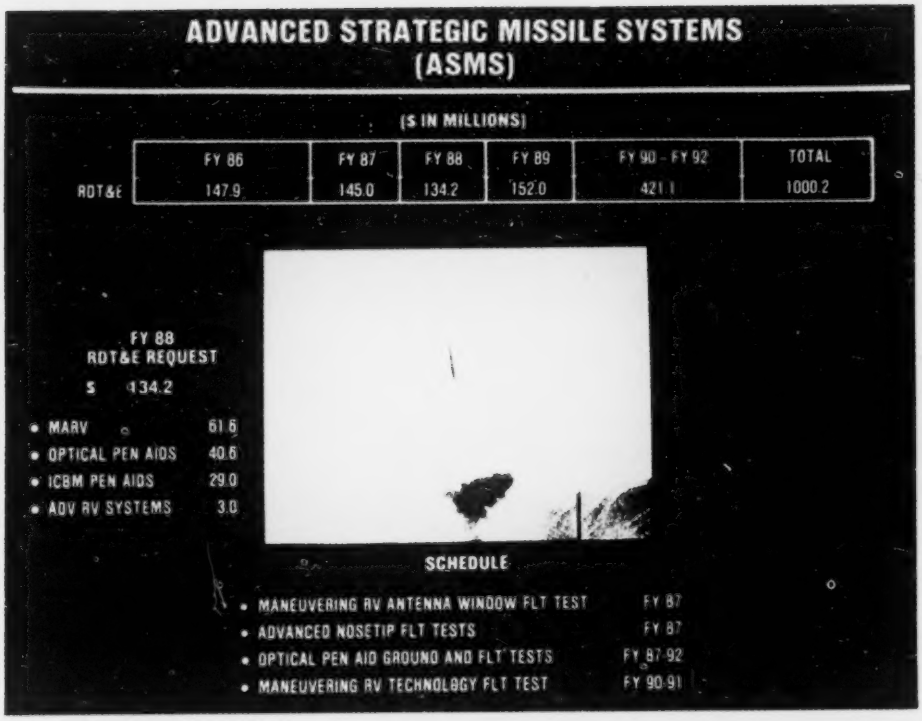
I would also like to cover two other programs in ICBM modernization, sir.

We are anticipating entering full-scale engineering and development this year on a Minuteman III penetration aids program to deal essentially with the major upgrades that you are aware of, that the Soviets have accomplished in the Moscow area.


MINUTEMAN SQUADRONS
($ IN MILLIONS)
FY 86 FY 87 FY 88 FY 89 FY 90 FY 92 TOTAL
RDT&E 4.9 48.3 107.7 199.6 213.2 574.1
PROC 328.9 243.0 265.2 275.9 1380.5 2493.5
FY 88 RDT&E REQUEST
$ 107.7
• PENETRATION AIDS 77.1
• INT ELECTRONICS 17.9
• SEMICONDUCTOR PIECE PARTS 9.2
• PROGRAM SUPPORT 2.9
• PORT SECURITY SYS 0.6
FY 88 WPN SYS PROC REQUEST
$ 265.2
• CLASS IV 119.2
• REPLEN SPARES 91.4
• REPLACEMENT EQMT 53.9
• INITIAL SPARES 0.7
SCHEDULE
• MOTOR REPLACEMENT IOC/FOC FY 86/93
• MM III PENETRATION AIDS IOC/FOC FY 92/93
• INT ELECTRONICS REPLMNT IOC/FOC FY 92/95

In our Minuteman Squadrons line, most of the money in 3600 is for this penetration aids development, in which we are not only putting new chaff on the appropriate systems, but we are also developing decoys. We continue to modernize the Minuteman II and Minuteman III systems. We have changed out some of the stages, remanufactured and repoured the stages over the years, and we continue to do that in this budget request for Minuteman III.

We continue to improve the communications, to insure that they are suitably hardened, and to insure that the crews can react to the emergency action messages when and if required.



Finally, sir, we have an advanced strategic missile program, which is fundamentally the Nation's only program to look into the future and determine what technology is available, to develop that technology, and to have that technology available on the shelf to respond to potential efforts on the part of the Soviets to improve their system of defending their nation.

We have a number of on-going programs at the level of funding that you see in this particular chart.

The Minuteman III penetration aids program was in this particular line last year, and we moved it out this year because we are entering full-scale engineering and development.

THE SOVIET ATTACK DILEMMA
1996
SOVIETS KNOW

- DAY TO DAY DETERRENCE
  - —ONE-THIRD OF BOMBER FORCE CAN LAUNCH ON TACTICAL WARNING
  - —TWO-THIRDS OF BALLISTIC MISSILE SUBMARINES AT SEA
  - —ROAD MOBILE SMALL ICBM CAN DASH FOR SURVIVABILITY ON TACTICAL WARNING
  - —ICBMs CAN LAUNCH WITHIN MINUTES OF LAUNCH DECISION
- ON ANY INDICATION OF INCREASED TENSION OR CONCERN, U.S. CAN
  - —DISPERSE RAIL GARRISON ICBMs TO RAIL MOBILE
  - —INCREASE BOMBER ALERT FORCE
  - —INCREASE BALLISTIC MISSILE SUBMARINES AT SEA
- THE SOVIET PLANNER MUST ASSUME ALL THE ABOVE
- SOVIET NUCLEAR ATTACK WOULD BE A CAREFUL, DELIBERATE DECISION

Finally, sir, all of our effort is designed, as Dr. Woodruff pointed out on his slide, to deal with the Soviet planner.

We understand clearly that deterrence is based on rationality. If you are dealing with a rational opponent and you are able to increase his uncertainty that he can deal with your force structure and at the same time increase his certainty that you will be able to cause great damage to the value structure that he has worked long and hard to build, we think that you are maintaining and, hopefully, improving deterrence as we move into the 21st century.

We continue to keep in mind how our force structure is viewed from Moscow, from the Soviet planner's perspective.

Thank you very much, Mr. Chairman.

Senator EXON. General May, thank you very much.

We will proceed on the 6 minute rule.

Let me start out by going back to the picture that you had of the rail-mobile system.

RAIL-MOBILE SYSTEM

If we can disperse the MX on a rail-mobile system, why couldn't we also disperse it on trucks? Has there been any thought given to the possibility of making this system further mobile by also dispersing it on trucks? Couldn't a similar truck system also be held on bases, just like the rail system is? The total transportation system in the United States today is based on the movement of heavy equipment by truck and by rail.

Dr. WOODRUFF. Do you want me to take that, Senator?

Senator EXON. Yes, whoever prefers to answer.

Dr. WOODRUFF. In fact, the Air Force did consider, in its studies, a road-mobile Peacekeeper system, and the problem was that the truck got very large. You can have two situations.

One, if you do not harden the truck, you are talking about a truck that probably weighs in the neighborhood of, I guess, about a million pounds.

Senator EXON. Well, let's back up a minute.

Are these hardened cars that you have for rail?

Dr. WOODRUFF. I was going to go through that.

The rail cars are unhardened.

Senator THURMOND. They are hardened, did you say?

Senator EXON. No, they are not hardened.

Dr. WOODRUFF. They are not hardened. The hard-mobile launchers for the small missile are hard. You need less area, of course, dispersal area.

Senator EXON. Don't start comparing the two. Answer my question about the trucks.

Dr. WOODRUFF. You can make a truck, but it would have very little mobility. You could make a truck. It would weigh about 1 million to 2 million pounds to carry the Peacekeeper missile. It could move out, probably on the roads, very slowly.

Senator EXON. How slowly? Five miles per hour? Twenty miles per hour?

Dr. WOODRUFF. To answer that, I would have to go back and get some engineering.

General MAY. Sir, the basic study we did was for the hard-mobile launcher for the Peacekeeper, and it was fundamentally a 2 million pound vehicle.

Senator EXON. That was hardened?

General MAY. Yes, sir.

We didn't actually do a study of a truck base, but I think some of the things, as Dr. Woodruff pointed out, that would cause us problems would be the overall weight in comparison to the capabilities of the road. We might be very limited in terms of only using interstates and so forth.

We will have to get you a better answer to that question for the record. I just don't have that information available to me today.

Senator EXON. I wish you would get that for the record.

[The information follows:]

HARD-MOBILE LAUNCHER FOR PEACEKEEPER

The vehicle for a hardened, ground-mobile Peacekeeper would weigh about 1.5 million pounds. This would greatly exceed the capability of our existing roads and bridges. A special road network would be required. Since the vehicle would be large, it would be restricted to a relatively low average speed of about 15 mph.

Senator EXON. It seems to me, if we are looking for mobility, I would say that one of the criticisms that I have heard, justified or not, is that you have over-complicated the basing mode for the Midgetman.

You know, there was talk in the beginning of putting Midgetman in the back of a pickup truck.

I guess it is my feeling that not only looking at costs, but looking at mobility, if we can move these things about and if we are going to have more warning time than we thought we had when we started with some of these other programs—well, that is why I asked the question whether the speed of a truck system was 5 miles an hour or 20 miles an hour.

If you are going to have adequate warning time, then it changes what you have to do, it seems to me, with regard to speed.

Let's go to what I think is a key question that is going to be faced by this committee and others.

In our various charts, you showed that the small ICBM force of 500 warheads deployed in the system that you are recommending would be $44 billion to $48 billion. You say that the rail-garrison MX system of 500 warheads would be $13 billion to $15 billion?

My arithmetic tells us, therefore, that if we go ahead with the plan that you have outlined here, we would be spending $31 billion to $33 billion more—more, I emphasize—for the dual systems of MX and the small ICBM.

Is that a fair way to characterize this issue? Is that one good way to look at it?

Have I fairly characterized it?

Dr. WOODRUFF. You have to define "more" for me.

To get those two systems, relative to one system, that is correct.

General MAY. Sir, I might add a comment, if I may.

The Air Force and the Department of Defense have testified over the past few years that we have a requirement for 1,500 quality RVs, and the program that we have presented to the Congress is a program to get us that number of RVs.

It seems to us that the synergism that results from having 500 Peacekeeper RVs in Minuteman silos, 500 Peacekeeper RVs in a mobile rail system and 500 small ICBMs in the hard-mobile launcher provides us with an optimum deterrent posture to move into the 21st century.

We do not see it today as a requirement to trade one for the other in terms of trying to have the optimum deterrent posture for the Nation.

Senator EXON. My time is up, but I want to give you both a chance to answer this question.

It seems to me that to justify this, we have to recognize, realize, and state for the record that we are contemplating spending, and you are recommending that we spend, an additional $31 billion to $33 billion, to get the system that you are recommending. Essentially, I think the only reasons for that would be that you are paying that much more for the tactical warning scenario that we hear so much about.

Is that correct?

General MAY. Sir, I think we certainly have a more robust system to deal across the spectrum of warning or the spectrum of how war might start. But, at the same time, we see great military utility in a single warhead system.

We have single warheads today in our inventory in the Minuteman II, and we see an end of life for the Minuteman II system.

We think the Nation is best served with a new, single warhead system in our inventory.

Today, our plan is to build that Small Missile and to base it in a hard-mobile launcher, which gives us not only the single warhead that we need, but, at the same time, gives us the capability to deal across the threat spectrum.

Dr. WOODRUFF. But I would agree, Senator, that your reason is the fundamental one.

Senator EXON. What was that?
Dr. WOODRUFF. What you said is fundamental.
Senator EXON. Thank you.
Senator Thurmond.
Senator THURMOND. Thank you, Mr. Chairman.

TRUCKS

I think the point the distinguished chairman has raised here about trucks is certainly worth looking into.

It seems to me that that could save millions of dollars in cost, certainly for part of them, if not all of these missiles, that are being transported.

I would suggest that you look into that very carefully.

Dr. WOODRUFF. Yes, sir.

Senator THURMOND. Dr. Woodruff and General May, how does each of you assess our ability to sustain the Peacekeeper missiles on the Nation's rail network and Small ICBMs deployed in hard-mobile launchers during extended periods of alert, both before and after the initiation of nuclear hostilities?

General MAY. Sir, as far as the rail-garrison operation is concerned, our initial look tells us that we should have enormous capability to carry the kinds of logistic support items that you would need in order to endure for a specified period of time, to include carrying with you your own fuel, if you chose to do that.

At the same time, with the Small Missile, we have done some initial studies that tell us that we should not have any difficulty enduring for a short period of time; but we are conducting, during this phase of our development, some trade-off studies to make sure we understand how, and how much it would cost to increase significantly the endurance capability.

We consider the problem of endurance to be a major problem that has to be solved in the development process of both of these systems.

Dr. WOODRUFF. I might add that we have not fixed an endurance number for the rail garrison. I think it is too early to do that.

SUSTAINING STRATEGIC SUBMARINES AND BOMBERS

Senator THURMOND. Dr. Woodruff and General May, how would you each compare our ability to sustain strategic submarines and bombers in the same circumstances of extended alert?

Dr. WOODRUFF. I will go first.

I think, clearly, I would put them in the following order.

The submarine, by design, has more post-attack endurance than the other legs of the triad.

On the other hand, I think that the ICBMs, particularly these mobile ICBMs, may have great extended endurance. But we really have not decided, particularly for the rail garrison, what that should be.

The survivability and endurance of the bombers, I think, depend on the scenario. In a limited kind of conflict, they also have great endurance. In a major conflict, you have to ask questions about where they would go and how long they would survive.

I would put them in that order: submarines, missiles, and bombers.

General MAY. Sir, I might just add that the operational command for bombers certainly spends a lot of time working the problem of endurance for the bombers. I think, as we move out and attempt to have longer and longer periods of endurance for our strategic forces across the board, the command will be able to provide increasing endurance for the bomber force.

But it is a major operational concern day in and day out.

Senator THURMOND. Dr. Woodruff, you mentioned that for a number of years, we have supported a technology program to assure the long-term survivability of ballistic-missile carrying submarines.

TECHNOLOGY FOR ICBM SURVIVAL

Would you support a separate line item for this purpose for ICBM survival?

Dr. WOODRUFF. I have not thought about that, that it has to be separate. I certainly would support an item for ICBM survivability. Yes.

Senator THURMOND. General, would you care to express yourself on that also?

General MAY. Yes, sir.

I think in some sense the Advanced Strategic Missile System line in our budget is the program that we use in the Air Force to attempt to deal with the problem of survivability before execution as well as survivability after execution so that the missile can do the job it is designed to do.

So, I think we have that effort in our budget today, and we think it is oriented in the right direction for the problems that we see through the next two decades.

Senator THURMOND. Dr. Woodruff, the Department plans to retain the Minuteman force for the indefinite future, upgrading components as required.

At the same time, the Department proposes to replace the SRAM, a missile with technology from the same era.

What factors account for the differing approaches to maintain the capability inherent in these systems?

Dr. WOODRUFF. Well, there are significant differences.

In the Minuteman program, we have repaired some motors—we have not rebuilt the whole missile, and we have kept it alive by these kinds of upgrades. In the case of the SRAM-A, where we are starting to have problems with the motor, we see no "low cost way" to repair that whole motor. The cost estimates we have had so far to rebuild that motor are very close to what it cost to build a new SRAM-A, or what we call SRAM-II.

Did you want to add to that, Charlie?

General MAY. Sir, I might add something.

As Dr. Woodruff mentioned, we have done the second and third stages on our Minuteman missiles. At the same time, to compare systems, we have upgraded, primarily through software changes, the guidance and control system, so that we have significantly im-

proved the accuracy to deal with the changing target base in the Soviet Union.

We have also changed out the warheads and the RVs on the systems to do the same thing, and our problem with the SRAM-A is that if we do all those things, including a new motor, a new guidance and electronic system and a new warhead, our calculations tell us that it would be at least as expensive, if not more expensive, than building the SRAM-II.

I also might add, in the SRAM business, we have a low and decreasing inventory. In the missile business, because we have a different test philosophy, we have not reached the point where we need to be concerned about inventory, although we will have that problem as we go into the 21st century for some of our development efforts.

We will not have the lift vehicles to do the tests that we have been able to do in the seventies and eighties.

Senator THURMOND [presiding]. I believe my time is up.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

ICBM DECISIONMAKING

Mr. Woodruff, over the past 3 weeks and also in past years, we have received testimony from a number of people involved in the ICBM decisionmaking, from the Secretary of Defense, from the Joint Chiefs of Staff, regarding strategic priorities. Each one of the witnesses from whom we have heard this year has confirmed a priority list that, in order, goes B-1, MX, D-5, ATB, ACM and, last, the Small ICBM.

From you vantage point in R&E, do you see the priorities the same way as these witnesses who have preceded you?

Dr. WOODRUFF. It is important that I am in acquisition.

I think that the rationale that was given for that is the timeliness of those. Those were sort of rank ordered when they would be available.

That sounds right to me.

Senator WILSON. General May, could you tell the committee why the Air Force has changed its baseline configuration for basing the small ICBM from the Southwest reservations to the Minuteman sites? Is it because of cost saving?

General MAY. Senator Wilson, the announcement that the President made indicated that we would first go to Malmstrom Air Force Base, a Minuteman site, and we would keep open the option to go to Southwest basing in the future.

The basic ingredient or the primary variable in selecting the Minuteman sites certainly was cost considerations, but we also kept in mind some of the manpower implications of going to the Minuteman sites.

Fundamentally, our calculations indicated that we were able to deal with a price to attack that was greater than two times what we expected the Soviets to use in holding at risk our Small Missile on Minuteman sites. So it told us that that was a good decision to make in order to begin the program.

Senator WILSON. So, this decision is cost driven.

I am interested because it seems to me, if I recall correctly, that the Defense Science Board recommended against the Minuteman sites, even though it would have obvious cost savings in terms of a degradation of the survivability that would be suffered as a result, especially in the "bolt out of the blue" scenario.

General MAY. Sir, we were very sensitive to the threats that were portrayed by the Defense Science Board.

It was our judgment, though, that at this point in time, those were future threats, and it was our judgment that we would maintain the capability to move into Southwest basing once those threats became present threats rather than future threats.

So, we were convinced that we had to keep open the basing option in the Southwest, which we have done with the President's announcement, and we continue to do the environmental studies and the planning associated with random basing at the Texas-New Mexico site that we identified, as well as the Arizona site.

Senator WILSON. In other words, your confidence in Soviet targeting is such that you think that you can afford, for the time being, to be in the Minuteman sites, but at such time as they enjoy an enhanced capability, you intend to move?

General MAY. Sir, we have kept open that option so that, if the threat changes, we can react to the threat with a system that we have, rather than having to procure another system.

Senator WILSON. Let me ask this of both of you. If Congress, owing purely to budgetary constraints, were to impose a total cost ceiling on the Small ICBM program at, say, $10 billion, or $15 billion or even $20 billion, wouldn't it be likely that you would be forced either to put the small missile in silos or to adopt a carry-hard basing mode or even to put it on rail cars?

General MAY. Sir, the slide that we showed earlier indicated that the R&D, as we understand it today, in then-year dollars would run us a little over $11 billion.

To develop the missile, that is what it would cost us.

For a basing option beyond that, other than the hard-mobile launcher, we have not done any kind of costing. To answer specifically where we could or would recommend that the missile go, I would have to provide that for the record. Clearly, with another $4 billion to $9 billion, if I understand your figures, we would not be able to put the number that we envision today into a hard-mobile launcher.

Dr. WOODRUFF. I will add to that.

I am not sure that it makes any sense for that size missile, if you are going to limit the cost to that level.

Senator WILSON. Isn't it likely, then, that, when all is said and done, if we string this program along, we will continue to make survivability tradeoffs, as it seems to me has already been done, in order to achieve affordability in this program? Won't we actually wind up being in a worse position, being worse off, than we would be for the same money with a rail-mobile MX?

Dr. WOODRUFF. Well, sir, as I said before, I think the Air Force has done a good job. They have driven the cost of this system, with its survivability attributes, down to about as low as it is going to get.

If you want to switch the way in which it gets survivability, like go to a rail-garrison system, then I am not sure a small missile makes sense.

Senator THURMOND. I believe the Senator's time has expired.

Let me say that Senator Gore is not a member of the subcommittee, but we are very pleased to have him here.

Would you care to ask any questions, Senator Gore?

Senator GORE. Yes, I would, and thank you very much, Senator Thurmond.

RAIL GARRISON

I found the testimony very interesting. I have previously stated my tentative support for the research funding for rail garrison. But I think that it is being oversold to some extent because it has not yet been proven.

In any event, I think there is a synergy or a complementary relationship between Midgetman and rail-garrison MX that General May, at least, has referred to. The synergy is in one direction and not the other. The Midgetman provides additional survivability for the rail-garrison MX, but not the other way around.

We have had discussions of strategic warning, and I would just note briefly, in passing, that at a time of great tension, a decision to roll these MX rail-mobile missiles out of the garrisons and begin to move them along the tracks, that development itself would add greatly to the tension accompanying whatever crisis preceded the warnings which led a decisionmaker to make that kind of decision.

Let me turn to the case for rail garrison.

First of all, do you know how many pounds per square inch blast pressure a rail car for MX can take and not be blown over?

General MAY. Sir, I don't believe we know that figure for sure today.

We are looking at hardening in three different categories right now. We are looking at 3 pounds per square inch, 7 pounds per square inch, and 10 pounds per square inch. And, of course, we are concerned with that particular variable, primarily because it influences the price to attack.

Senator GORE. What is the base case that you are using for estimating purposes? Is it seven?

General MAY. I hear two different numbers in the back, but somewhere between four and seven we have used to determine the price to attack. That is the key reason that we use that variable at this point in time.

SS–18

Senator GORE. Have you calculated the amount of track that an SS–18 can cover, based on your blast pressure figure and your base case, with warheads laid down along the length of the track? If so, how much track is it? How much track can an SS–18 cover?

Dr. WOODRUFF. If you get down to too much detail, it gets classified. But let's just say, based on what was just said, that that works out to be about three to four miles of track per warhead.

Senator GORE. So, an SS–18 could cover approximately 40 miles of track.

Dr. WOODRUFF. You'd have to talk about the number of warheads on an SS–18 times that.

Senator GORE. Let's assume that we have 10. Then it would be 40 miles per track.

All right. So, one SS–18 can cover approximately 40 miles of rail track.

Have you estimated, by actual measurement of rail lines, how many miles of track the MX could occupy within 1 hour of the order to disperse?

Dr. WOODRUFF. I had a chart up earlier that suggested that.

Senator GORE. I saw your chart, but it emphasizes the much longer lead-times and compresses the shorter periods that I am asking about.

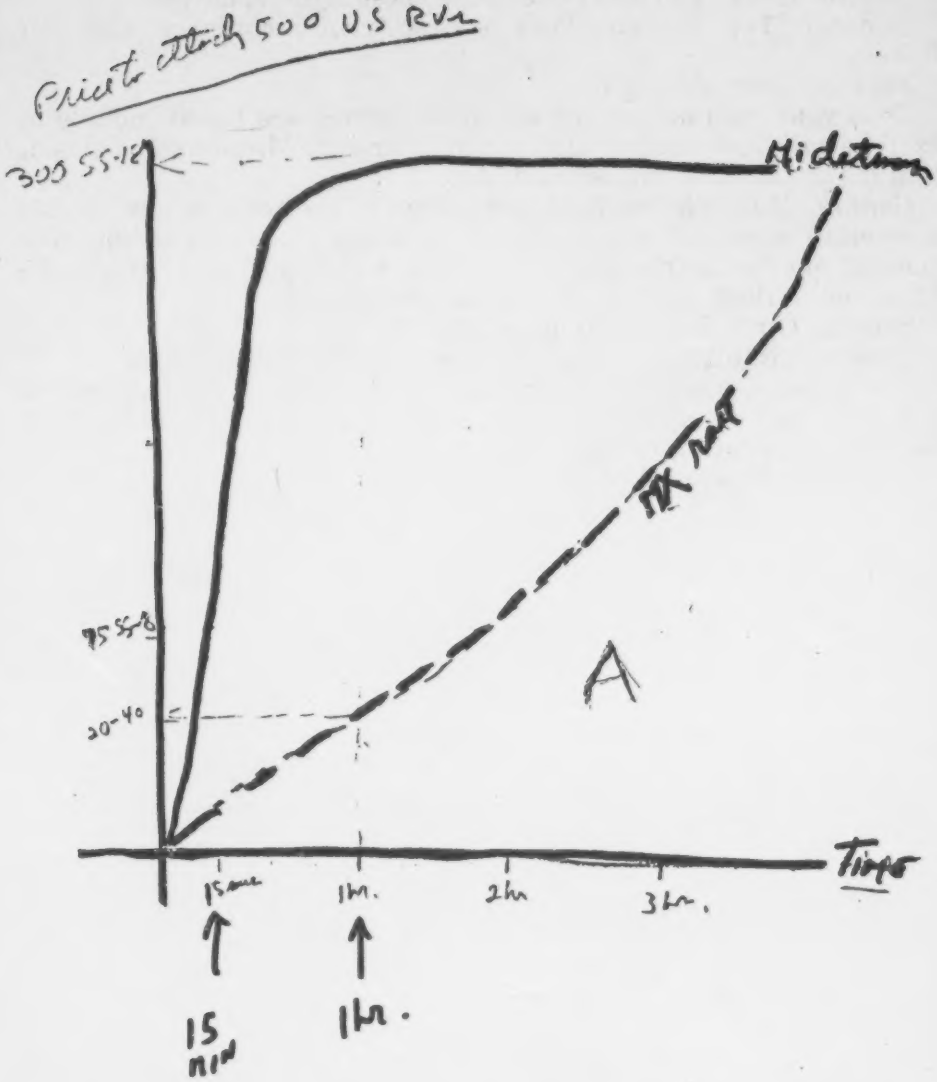
I would ask the projectionist to put up a transparency that is not quite as sophisticated or polished as the ones that you all have had, but if you could slide it up a little bit, you will see that the first tick is 15 minutes, the second one is one hour.

The figures used to make these calculations are the same. They are also based on 40 miles of track per SS–18.

What you see from that is that the Midgetman can require 300 SS–18s to take it out within 15 minutes.

The rail-garrison MX would require more than 3 hours to exact the same price to attack.

[The chart of Senator Gore follows:]


Fricke Attich 500 U.S RVu
300 55-12
75 55-8
20-40
Undetermined
TIK Test
A
Time
15 min
1hr.
2hr
3hr.
15 min
1hr.

Senator GORE. You don't challenge those figures, do you?

General MAY. No, sir. That is exactly in accordance with our figure.

Senator GORE. All right.

Does your estimate on which these figures are based include or exclude rail lines that would lead MX through Minuteman fields or into major cities or onto dead ends?

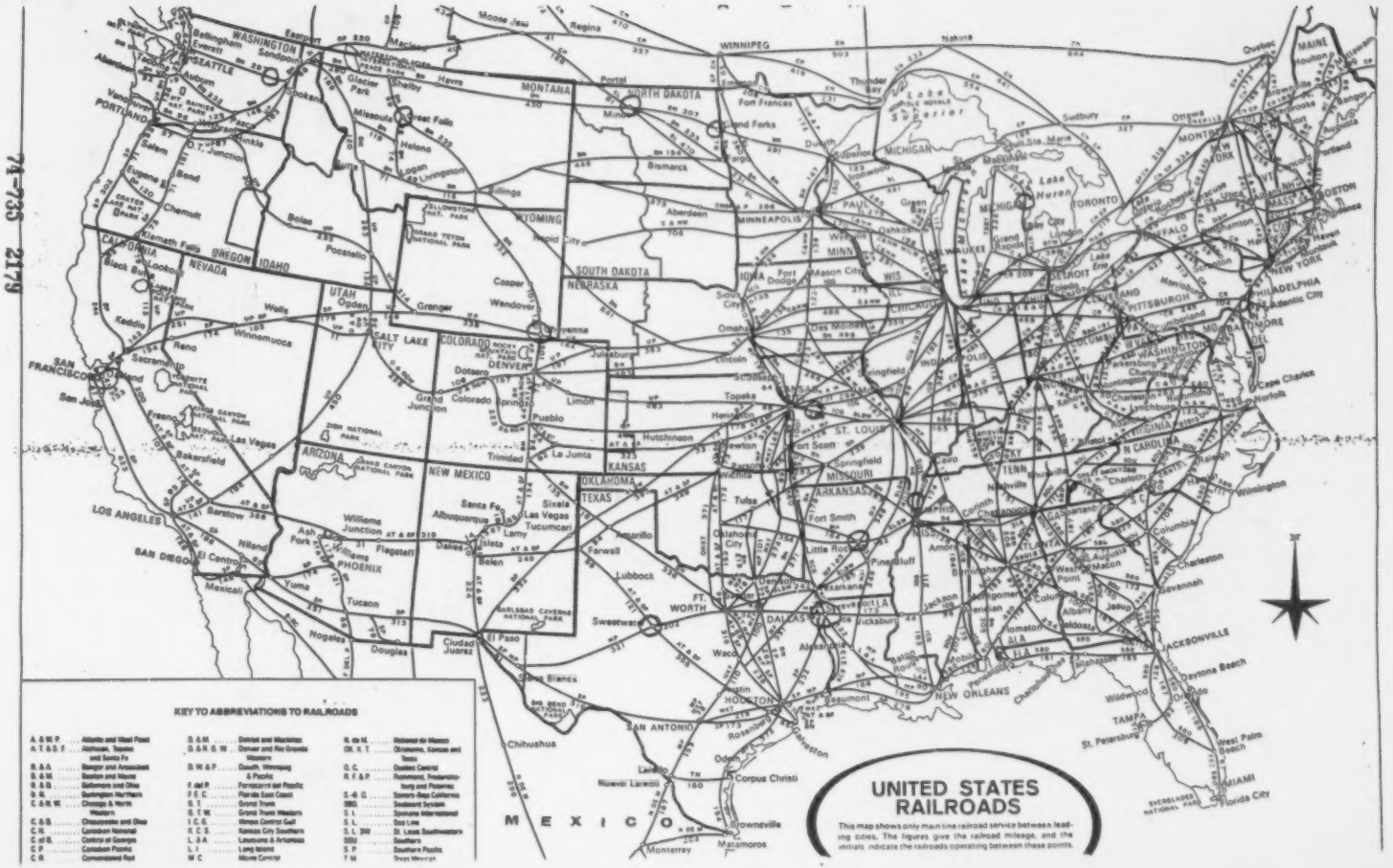
General MAY. Sir, we have not gotten to the point where we can answer in absolute specific detail for every possible location. The general answer is that we have excluded that portion of track, the Minuteman field and nearby population centers.

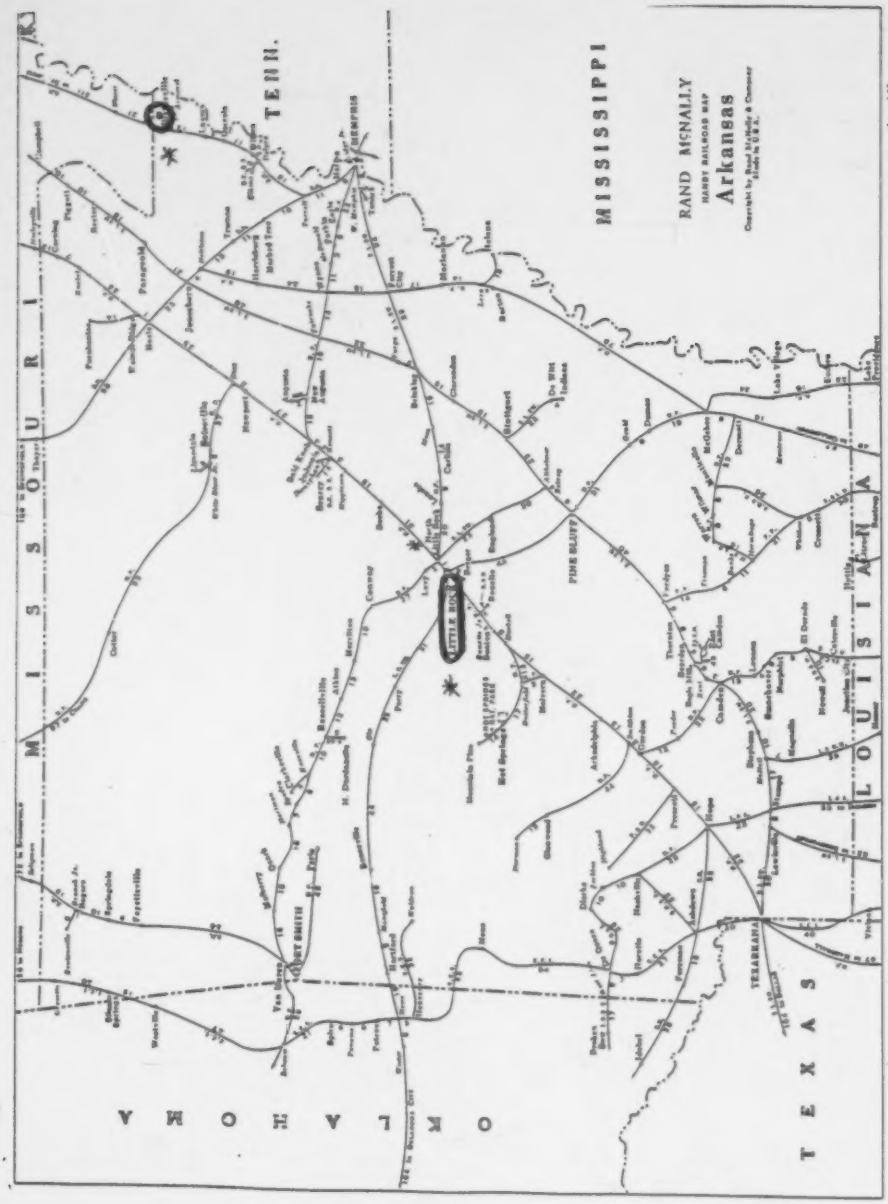
Senator GORE. I understand.

To short-circuit this, I am informed that the answer is no.

I have here, which I will provide for the record, the locations of the sites that were talked about. I got from the Rail Association the rail maps for all of these sites.

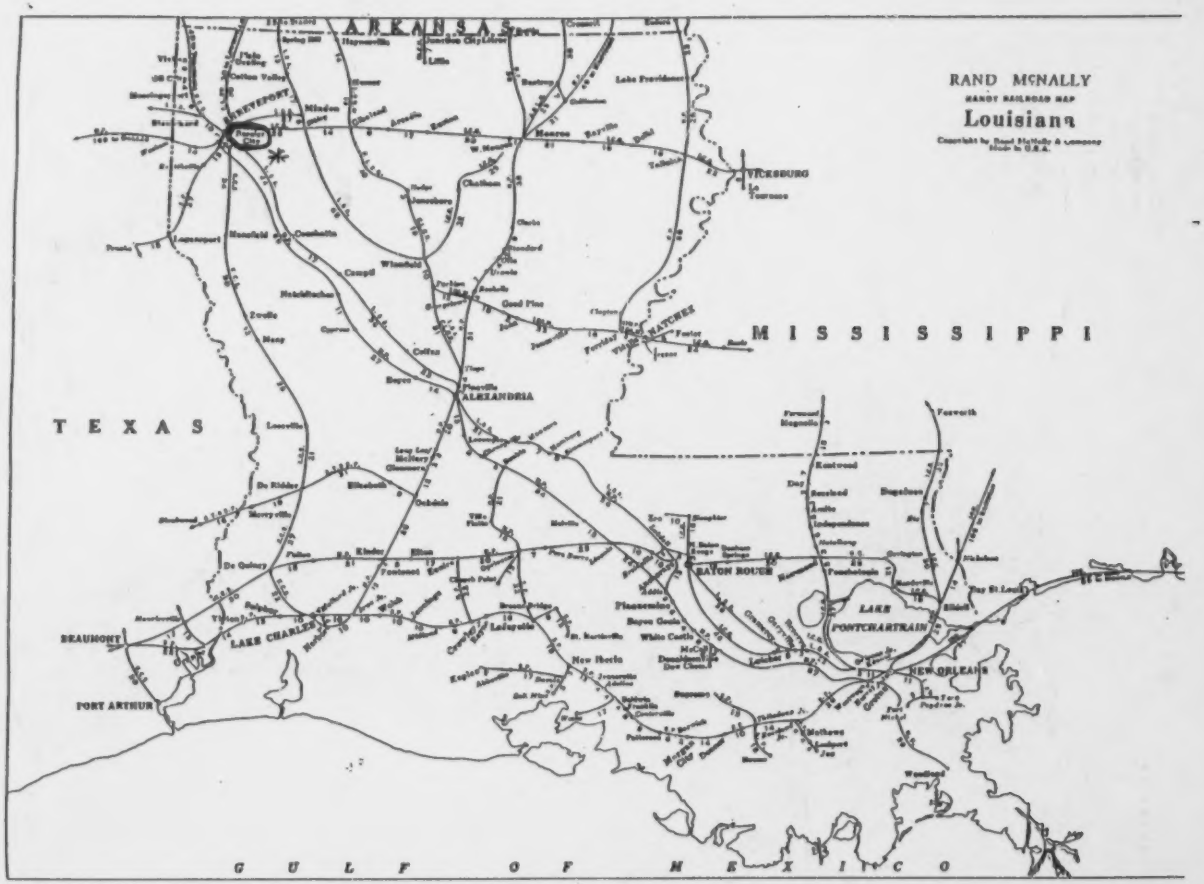
[The information follows:]


KEY TO ABBREVIATIONS TO RAILROADS
A & W P ..... Atlanta and West Point
A T & S F ..... Atchison, Topeka and Santa Fe
B & A ..... Bangor and Aroostook
B & M ..... Boston and Maine
B & O ..... Baltimore and Ohio
B N ..... Burlington Northern
C & N W ..... Chicago & North Western
C & O ..... Chesapeake and Ohio
C N ..... Canadian National
C of G ..... Central of Georgia
C P ..... Canadian Pacific
C R ..... Conrail
D & M ..... Detroit and Mackinac
D & R G W ..... Denver and Rio Grande Western
D W & P ..... Duluth, Winnipeg & Pacific
F and P ..... Forrestville and Pacific
F E C ..... Florida East Coast
G T ..... Grand Trunk
G T W ..... Grand Trunk Western
I C G ..... Illinois Central Gulf
K C S ..... Kansas City Southern
L & A ..... Lowisville & Arkansas
L I ..... Long Island
M C ..... Maine Central
N de M ..... National de Mexico
OK. K. T ..... Oklahoma, Kansas and Texas
O C ..... Ontario Central
R F & P ..... Richmond, Fredericksburg and Potomac
S-P G ..... Southern Pacific California
SBD ..... Seaboard System
S L ..... Spokane International
S L ..... Soo Line
S L SW ..... St. Louis Southwestern
SOU ..... Southern
S P ..... Southern Pacific
T M ..... Texas Mexican
UNITED STATES RAILROADS
This map shows only main line railroad service between leading cities. The figures give the railroad mileage, and the initials indicate the railroads operating between these points.
MEXICO
WASHINGTON
OREGON
CALIFORNIA
NEVADA
IDAHO
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
MINNESOTA
IOWA
MISSOURI
ARKANSAS
LOUISIANA
WISCONSIN
ILLINOIS
MICHIGAN
INDIANA
OHIO
KENTUCKY
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
MAINE
VERMONT
NEW HAMPSHIRE
MASSACHUSETTS
RHODE ISLAND
CONNECTICUT
NEW JERSEY
DELAWARE
MARYLAND
SEATTLE
PORTLAND
SAN FRANCISCO
LOS ANGELES
SAN DIEGO
PHOENIX
DENVER
SALT LAKE CITY
ALBUQUERQUE
EL PASO
HOUSTON
SAN ANTONIO
DALLAS
FT. WORTH
OKLAHOMA CITY
KANSAS CITY
ST. LOUIS
MINNEAPOLIS
CHICAGO
DETROIT
CLEVELAND
BUFFALO
PITTSBURGH
PHILADELPHIA
BALTIMORE
WASHINGTON
NEW ORLEANS
ATLANTA
JACKSONVILLE
MIAMI
TAMPA
TORONTO
MONTREAL
WINNIPEG
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
1919



Little Rock AFB is 12 miles NE of Little Rock. Blytheville AFB is 4 miles NE of Blytheville

BRGM



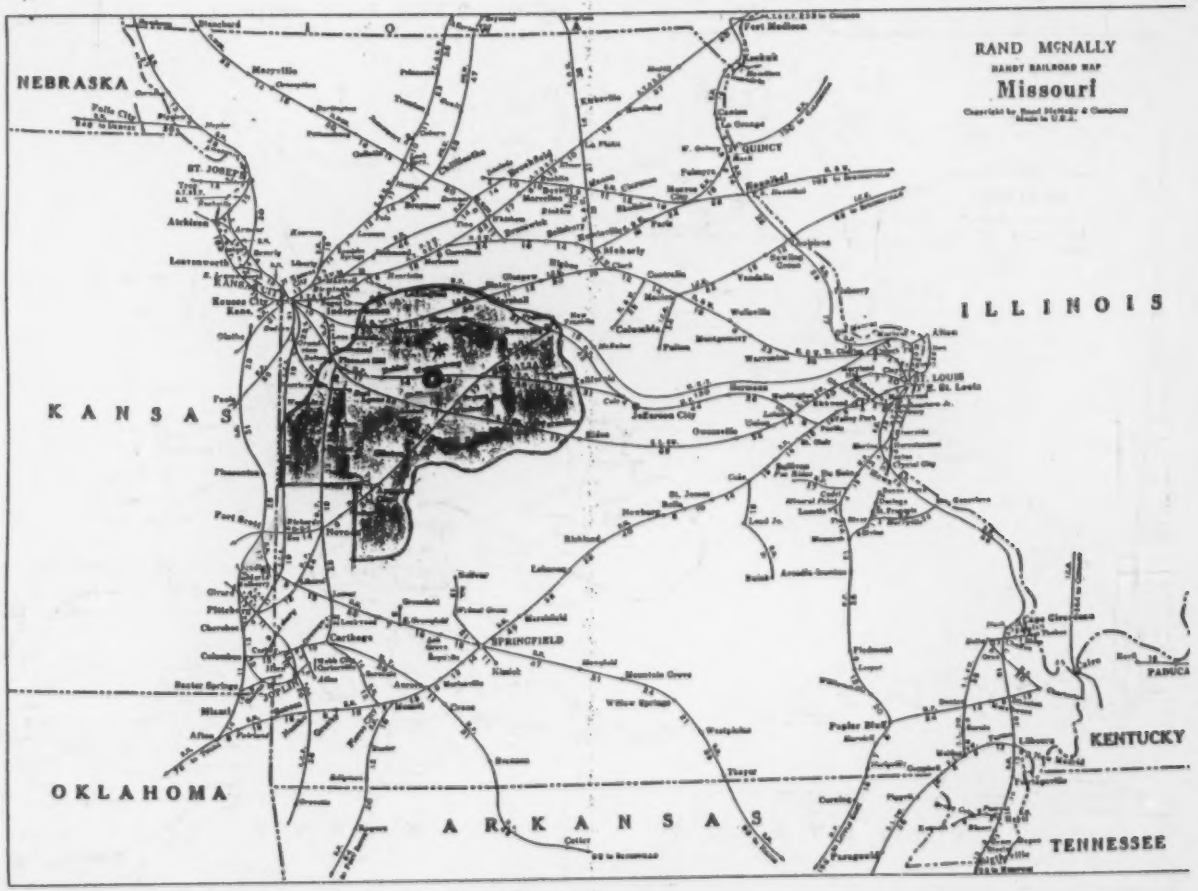
1921

Barksdale AFB is in Bossier City

1922

Wurtsmith AFB is 3 miles NE of Oscoda.

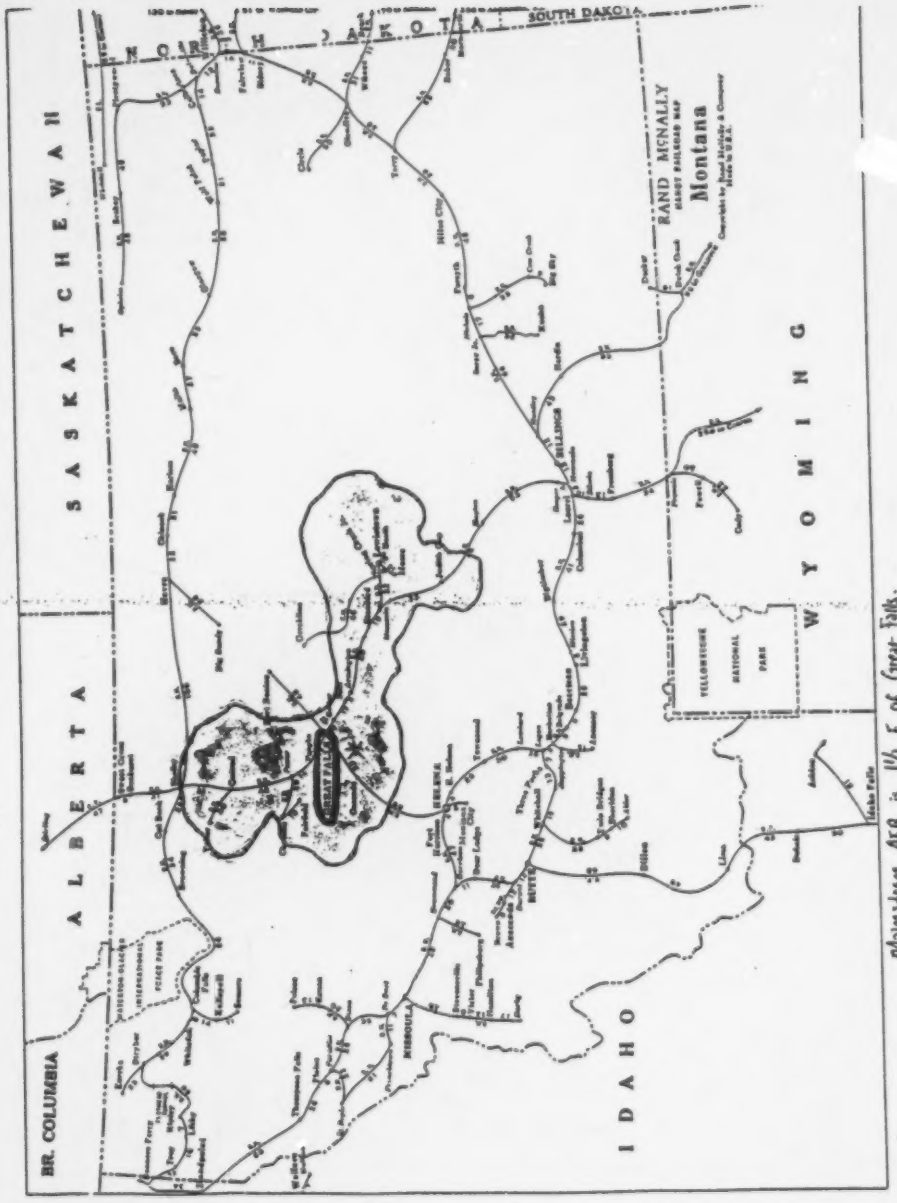
BRONS



* Whiteman AFB is near Warrensburg.

1923

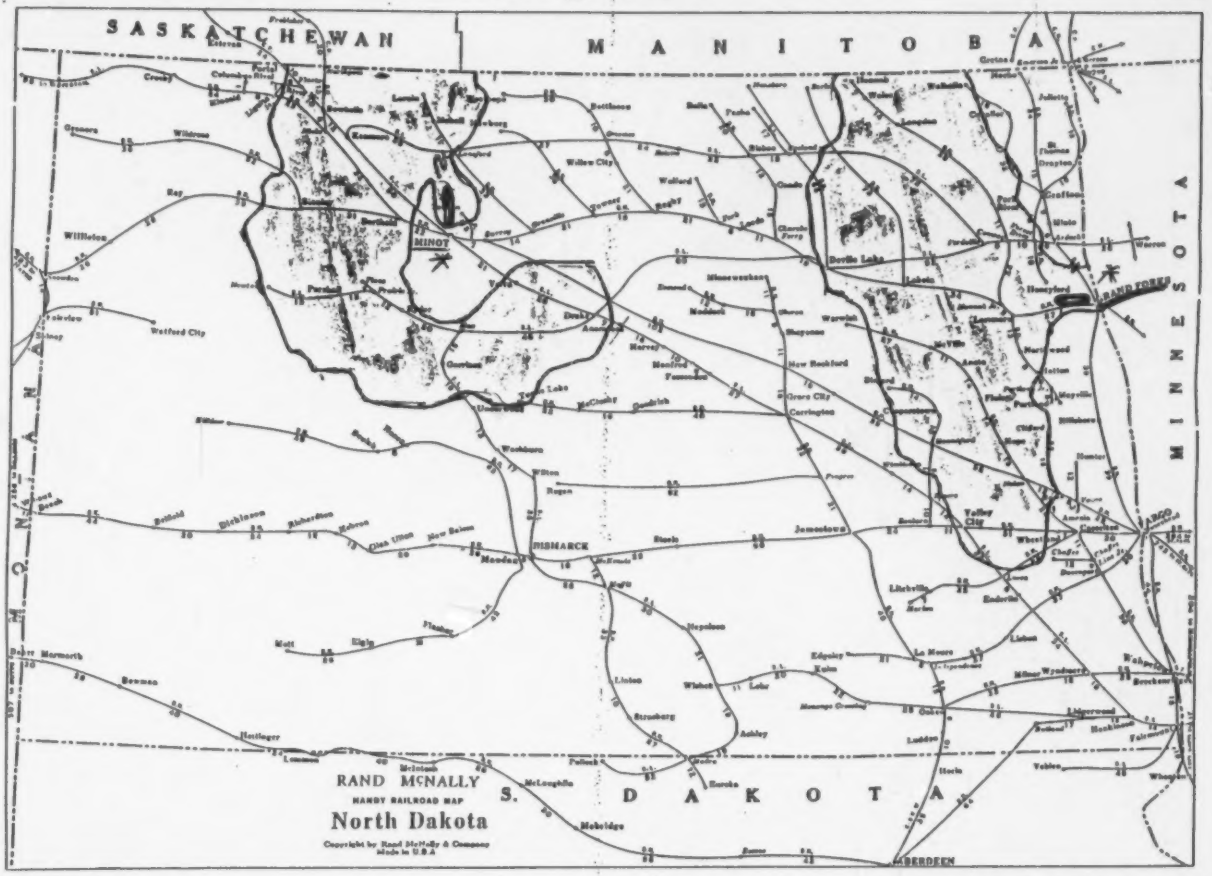
1924


NORTH DAKOTA
SOUTH DAKOTA
SASKATCHEWAN
ALBERTA
BR. COLUMBIA
WYOMING
IDAHO
RAND McNALLY
Montana
YELLOWSTONE
NATIONAL
PARK
GREAT FALLS
Malmstrom AFB is 1½ E of Great Falls.

GEORGIA

BROCK

496

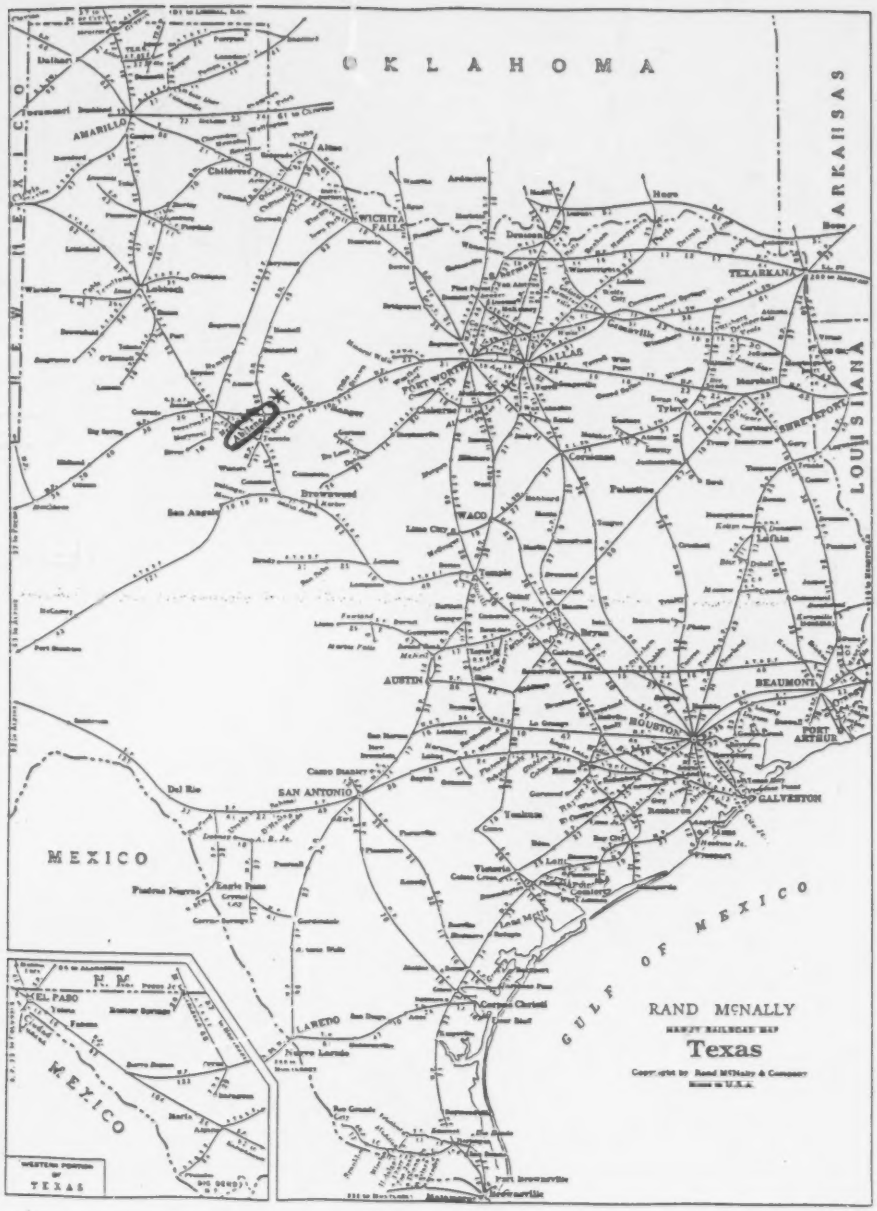


1925

Minot AFB is 13 miles N of Minot

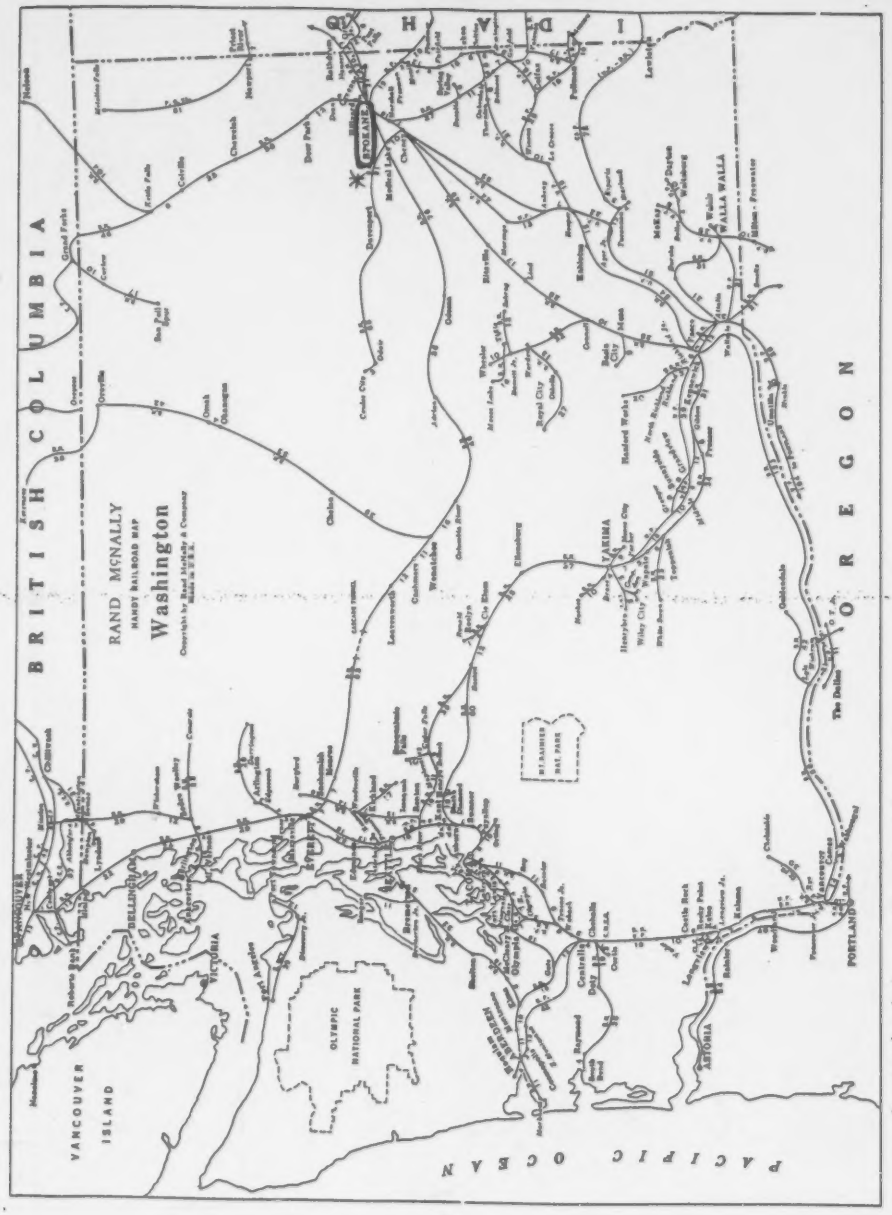
Grand Forks AFB is 16 miles W of Grand Forks.

1926

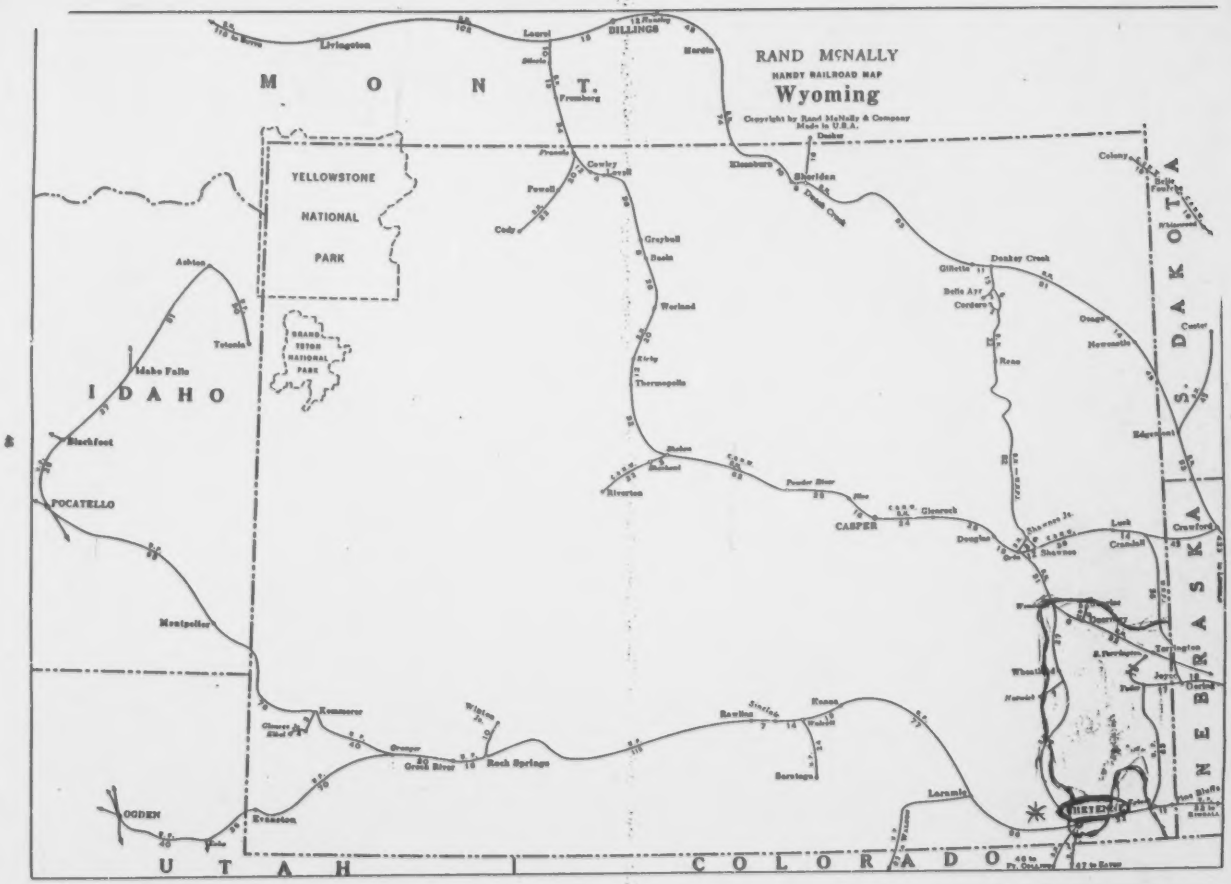


Dyess AFB is on the West-Southwest border of Abilene

1927



Fairchild AFB is 12 miles W of Spokane



F. E. Warren AFB is in Cheyenne

1928

Senator GORE. It appears that for Whiteman Air Force Base and for Malmstrom Air Force Base, for Minot and Grand Forks, the first period of time takes these linear tracks through Minuteman bases that are going to be saturated in any event. And so, these figures have to be adjusted heavily to account for that.

Second, some of the others that you look at, the Little Rock Air Force Base, for example, and all the talk about 3 hours time—3 hours time gets you to Memphis or to New Orleans—presumably you would not be driving the MX into the heart of New Orleans during a time of crisis.

So, it has to be adjusted for that as well.

If you make those adjustments, how many miles of track in total could be occupied in 1 hour? If you don't know that right now, please provide that for the record.

You wouldn't have that answer right now, I am sure.

General MAY. I would like to provide it for the record, sir. But, if I may, the calculations that we have done in terms of miles and so forth are calculations that don't involve MX occupying that track. They involve the calculation that the Soviet planner has to make as to where the train went during that period of time.

When you make those calculations, then dead-ends and cities and so forth play because it is not our calculation, it is the Soviet planner's calculation that is key to our analysis.

When we do that, we find at the end of 3 hours we are able to generate approximately 18,000 linear miles of track, which cause the Soviets to use a number of weapons, as you suggested.

[NOTE: Following the testimony the Department submitted for the record that the correct figure is 6 hours.]

[The information follows:]

PEACEKEEPER—LINEAR MILES OF TRACK

Our preliminary calculations, discounting track in urban centers and near Minuteman silos, show we can disperse to 18,000 miles of track in just 6 hours. This would force the Soviets to use their entire SS–18 inventory to attack just 10% of the track available to us.

Our preliminary calculations do not take credit for generating track within a 2 mile radius of a Minuteman silo or within the confines of nearby urban centers. We have not completed our studies on every possible location in the United States and will require fiscal year 1988 funding to do so.

Senator GORE. So, for public purposes, major cities are fair game as refuge for the rail-mobile MX. New Orleans, Memphis, and Detroit are all part of the basing mode.

General MAY. No, sir. I didn't mean to say that.

What I meant to say was the Soviet planner would have to make those kinds of calculations, and in our judgment, when he made those kinds of calculations, he would choose not to target the rail system; he would choose not to target our major cities; and it would be a major improvement in our deterrent posture vis-a-vis the Soviet Union.

Senator GORE. My time is up, so I cannot proceed further. But if the Soviet Union made those calculations, the Soviet Union might choose to kill it off in the first hour of a crisis, where the Soviet Union saw these things being rolled out of the garrison.

I have other questions which I will submit for the record, if we don't have another round.

Dr. WOODRUFF. May I make one more comment on that?

Senator LEVIN [presiding]. Yes, go ahead.

Dr. WOODRUFF. There is no issue. I mean, it takes hours. If he wanted to, he could do it with submarines in minutes.

It requires hours to get survivability with that system. I don't think that is an issue to debate.

Senator GORE. But what is an issue—if I may be indulged for just one more moment—what is an issue is that even after the 3 hours elapse, the survivability figures you are projecting assume a certain amount of miles of track, which may not be there. It assumes that you are going to have a certain speed with these trains which may not be there. It assumes that a large portion of the track during the first hours are not going to be saturated because the tracks are running through Minuteman bases. It assumes that there is not going to be some sabotage scenario blocking off some of the tracks over which the train runs. And it makes a series of other assumptions.

Dr. WOODRUFF. Agreed.

Senator GORE. All I am saying is the research is fine on it, but we should not speak as if the case has been proven that rail-garrison MX mobile has the survivability figures that are projected.

Senator THURMOND. Mr. Chairman, I just have one question and I have to leave, if you don't mind.

Senator LEVIN. Senator Thurmond.

Senator THURMOND. In response to Senator Gore, I would like to ask this question.

Senator Gore mentioned that the synergism between rail garrison and Small ICBMs is in one direction, that is, Small ICBM helps rail garrison but not the converse.

The question I want to ask both of you is this. Do you agree with this assessment? Are there any factors in which rail-garrison MX allows the attributes of the small ICBM to be used fully.

General MAY. Yes, sir. In my judgment, going back to what I said earlier about the total number of quality RVs that the Air Force has testified are necessary, in terms of cost, we are able to procure for a much lower cost 500 of those 1,500 required RVs. When we base them in rail garrison, we are able to hold at risk target complexes in a cost-effective way that we cannot do if we relied solely on satisfying the deficit of a thousand quality RVs with simply the single RV Small ICBM system.

Senator THURMOND. The first question was do you agree with the assessment that he made?

General MAY. I don't agree that that is the only variable, or that it is only synergistic in one direction. I believe that they complement each other in terms of an affordable SIOP.

We have testified on a number of occasions that the Peacekeeper, because of its cost effective nature, its communications reliability and so forth, is the basis of an affordable SIOP. Whether that is in Minuteman silos or rail garrison, we think that that remains true.

Senator GORE. Would the Senator yield briefly?

Senator THURMOND. I would be pleased to yield.

Senator GORE. The point had to do with price to attack synergy, and calculations by the Soviet Union on whether an attack would look more or less attractive.

I just want to note that the answer for the record does not address any price to attack synergy in the opposite direction. It is solely based on budget considerations.

I appreciate the Senator yielding.

Senator THURMOND. Certainly.

General MAY. I might respond to that.

Our calculations tell us that both of those systems deployed can cause the Soviets to run out of assets in order to hold both systems at risk; whereas, if you just had one of those systems, such as the HML, it could be within his current inventory to hold that system at risk in a tactical warning scenario.

Dr. WOODRUFF. I might comment that there is no question. If you can afford it, you could buy all small missiles to do this job, and they would provide survivability early-on. And that is fine.

Senator THURMOND. Thank you very much.

Senator GORE. May I ask one other brief question?

Senator LEVIN. Is it on this point here?

Senator GORE. Yes, it is—on the very point just interchanged.

What portion of the Soviet inventory would be required to destroy the small-mobile missile after 15 minutes? What portion of the SS–18 force?

All of it?

General MAY. Yes, sir.

Senator GORE. Thank you.

SURVIVABILITY BY HOURS

Senator LEVIN. Can you give us a comparison on survivability by hours? How many hours of warning do we need for the MX mobile to be survivable? I didn't quite follow that answer.

Dr. WOODRUFF. I think the chart we showed or the one that the Senator made——

Senator LEVIN. Have you put that on already?

Dr. WOODRUFF. Yes, we have, but we can put it back up again.

Senator LEVIN. Can you give it to me in hours, percentage of survivability?

Dr. WOODRUFF. It is in hours.

I don't want to get too detailed or it will get classified.

Which system did you want to talk about?

Senator LEVIN. The MX first.

Dr. WOODRUFF. The 300 SS–18 limit that we were just talking about is somewhere in here (indicating), and it is somewhere in here (indicating).

Senator LEVIN. I am not following you.

Dr. WOODRUFF. Hypothetically, I said 300 SS–18s could barrage tracks or land areas somewhere at this level (indicating)—10,000 miles of track.

Yours was 12,000.

If you come across to 12,000, this chart, realizing the reservations that you had, Senator, says 4 hours (indicating) for an attack price of 300 SS–18s.

Senator LEVIN. What percentage of the MX would be survivable with 15 minutes? Can you tell us that?

Dr. WOODRUFF. Practically none, if the Soviets knew that dispersal was limited to only 15 minutes.

Senator LEVIN. OK.

How much would be survivable with half an hour?

Dr. WOODRUFF. The ratio is here (indicating)—10 or 20 percent.

Senator LEVIN. How much with 1 hour?

Dr. WOODRUFF. I don't know—25 percent.

Senator LEVIN. And how much with 2 hours?

Dr. WOODRUFF. Thirty percent, 40 percent.

Senator LEVIN. Would you compare that to the Midgetman?

Dr. WOODRUFF. Well, 15 minutes, with an attack of 300 SS–18s——

Senator LEVIN. Right.

Dr. WOODRUFF [continuing]. Few survive in 15 minutes. But at half an hour, half survive, and so on. Of course, this assumes an attack price of about 300 SS–18s.

Senator LEVIN. Don't say "so on." Give me the 1 hour so that we have a clear comparison on the record.

Dr. WOODRUFF. In 1 hour, it is out something like to 25,000 square miles. He can barrage your 10,000 square miles, so 10,000 over 25,000, he kills one-third and two-thirds survive. Something like that.

Senator LEVIN. Now, reverse the question.

SOVIET RAIL-MOBILE OR TRUCK-MOBILE ICBM

We are now looking at a Soviet rail-mobile or a Soviet truck-mobile ICBM. What I would like to ask you is if there were a future East-West crisis and we saw the dispersal of their truck-mobile or rail-mobile missiles, would we view that as a provocative move on their part?

Dr. WOODRUFF. You are asking an engineer?

Senator LEVIN. Right.

Dr. WOODRUFF. I can only give you a personal opinion. I think it really depends on the scenario.

They do dispersal exercises now with their small missile. Do we think it is provocative? I don't think so.

Senator LEVIN. I am saying in a crisis atmosphere. Would we view the sudden movement of all of their truck-mobile or rail-mobile as a provocative move? Would you?

Dr. WOODRUFF. I would expect them to do that.

Senator LEVIN. In a crisis?

Dr. WOODRUFF. Yes.

Senator LEVIN. Would you view it as provocative? Would it create a sense of urgency on our part? Would it make you nervous?

Dr. WOODRUFF. I don't think so. I would expect them to do it. I would be nervous enough in a crisis situation.

General MAY. Senator Levin, if I might add a comment——

Senator LEVIN. General, would it make you nervous?

General MAY. Sir, we had a briefing this morning from General Doyle from the SAC staff, discussing the strategic indicators that he tracks on a daily basis. One of the things that we noted was that there are numerous indicators that are compiled to allow people in the military to make judgments and to advise the civilian

leadership as to what is going on with respect to Soviet strategic forces. Certainly, if those kinds of indicators came on the board, that would be passed along to the national decisionmakers, and they would react in a certain fashion.

We would be doing in a crisis situation similar kinds of things which we would expect the Soviets to be tracking. The question as to whether or not that would be stabilizing or destabilizing is probably, in my judgment, impossible to answer. But there certainly is an argument that it would be stabilizing, like perhaps moving the Strategic Air Command to the Southeasten United States during the Cuban missile crisis contributed to the satisfactory solution, from the United States' point of view, to that major crisis.

Senator LEVIN. Thank you.

MOBILE MX COSTS

Do you have an estimate of the cost of procurement of the MX mobile?

Dr. WOODRUFF. The preliminary estimates were in that piece of paper. It was $13 to $15 billion for the Small missile.

Senator LEVIN. I'm talking about the mobile MX.

Dr. WOODRUFF. It was $44 billion to $48 billion for the Peacekeeper in rail-garrison basing.

Senator LEVIN. That is the total procurement cost?

Dr. WOODRUFF. That was life-cycle costs. The procurement costs were $37 billion to $39 billion.

Senator LEVIN. I think you have them reversed. It was $13 billion to $15 billion for Peacekeeper in rail garrison——

Dr. WOODRUFF. Yes, I had them reversed.

Ten to $12 billion was the acquisition cost for Peacekeeper in rail garrison.

Senator LEVIN. All right, and $13 billion to $15 billion is for life-cycle?

Dr. WOODRUFF. Yes, that's the life-cycle.

Senator LEVIN. And then $37 billion to $39 billion for the small missile, and $44 to $48 billion for life-cycle.

Dr. WOODRUFF. Yes.

Senator LEVIN. Was there disagreement inside the Defense Department on the Midgetman issue? Were there some who felt that we should not proceed with Midgetman and some who felt that we should?

Dr. WOODRUFF. I think the issue was one of affordability, and trying to stack all of this up with the budgets that we are doing. There is in every program. With a program this large, yes, there was.

Senator LEVIN. Can you identify if there was a particular office or person in the Defense Department who opposed the Midgetman missile on affordability or other grounds?

Dr. WOODRUFF. I'm not sure that I understand the question.

Senator LEVIN. Did the Air Force recommend Midgetman to the DOD?

Dr. WOODRUFF. Yes.

Senator LEVIN. Was there anyone inside of the Air Force that you know of that argued against the acquisition of Midgetman?

Dr. WOODRUFF. Not to my knowledge.

Senator LEVIN. General.

General MAY. No, sir, other than in the normal budgetary debates. There was not any identifiable individual who was a champion of the anti-SICBM forces.

MX OR MIDGETMAN

Senator LEVIN. My last question is between these two systems, do you have a preference—MX or Midgetman—if we only go with one?

Dr. Woodruff.

Dr. WOODRUFF. The question was phrased earlier. I think our priorities were that we said the Peacekeeper first.

Senator LEVIN. General.

General MAY. Sir, General Welch has testified to that. Peacekeeper will be on line first. We have a deficit today, and we need more Peacekeeper weapons in the inventory.

Senator LEVIN. The short answer then is between the two, you, General, would go with Peacekeeper?

General MAY. Yes, sir, because it is earliest IOC.

Senator LEVIN. By 1 year?

General MAY. Yes, sir. But the number of warheads quickly escalates.

Senator LEVIN. Mr. Chairman, I don't know who is next. Since you are back, you can make that decision.

Senator EXON [presiding]. The only person here who has not had a first round, as I understand it, is the former Secretary of the Navy, and I recognize Senator Warner.

Senator WARNER. Thank you, Mr. Chairman. I appreciate the opportunity to come here as an ad hoc member of this distinguished subcommittee.

I just would like to ask amongst the membership, before I direct a question to you, not having had the opportunity to be here earlier, have we arranged sufficiently the questions so that we can sit down and analyze rail mobile versus small mobile?

Senator EXON. I think the answer to that is we have a pretty good record. We are probably going to do a little more of that. We have gone into that specific question in some detail. But if you would like to ask any general questions, go ahead and pose them.

Senator WARNER. All right.

RAIL-MOBILE SYSTEM

I am of the opinion that the rail-mobile system should be funded in terms of the R&D request. But, based on the knowledge that I have to date, we do not have, in the corporate sense, the Defense Department and Congress, a sufficient knowledge, to say that rail mobile is the direction in which we should go in terms of mobility, and that therefore we should terminate or attenuate the Midgetman program. So, my present disposition is that we should continue with both programs. That is my posture.

The question would be do you feel that we have a sufficient R&D base on rail mobile to justify a decision made by the Congress at this time to terminate or attenuate the small mobile?

Dr. WOODRUFF. No. I agree with your position.

Senator WARNER. And therefore we should at least have a year of R&D on rail mobile under our belts, so to speak, before we sit down, if driven by fiscal considerations, to a choice between those two programs.

Dr. WOODRUFF. In fact, that is our program. Yes.

Senator WARNER. That is my question and concern.

Now I would be glad to yield a little of my time to Mr. Wilson.

Senator EXON. Senator Wilson has had his first round. We are going to have a short second round, and I will be glad to recognize the Senator again at the appropriate time.

Senator WARNER. Well, I just wanted to yield some of my time because I know he has done a lot of work in this area.

Senator EXON. I would simply say that I intend to go into a rather short closed session as soon as we can bring our second round to a close. I think there are some questions that we had better go into in some detail that we cannot go into in open session.

But let me begin and I will try to be brief with my second round.

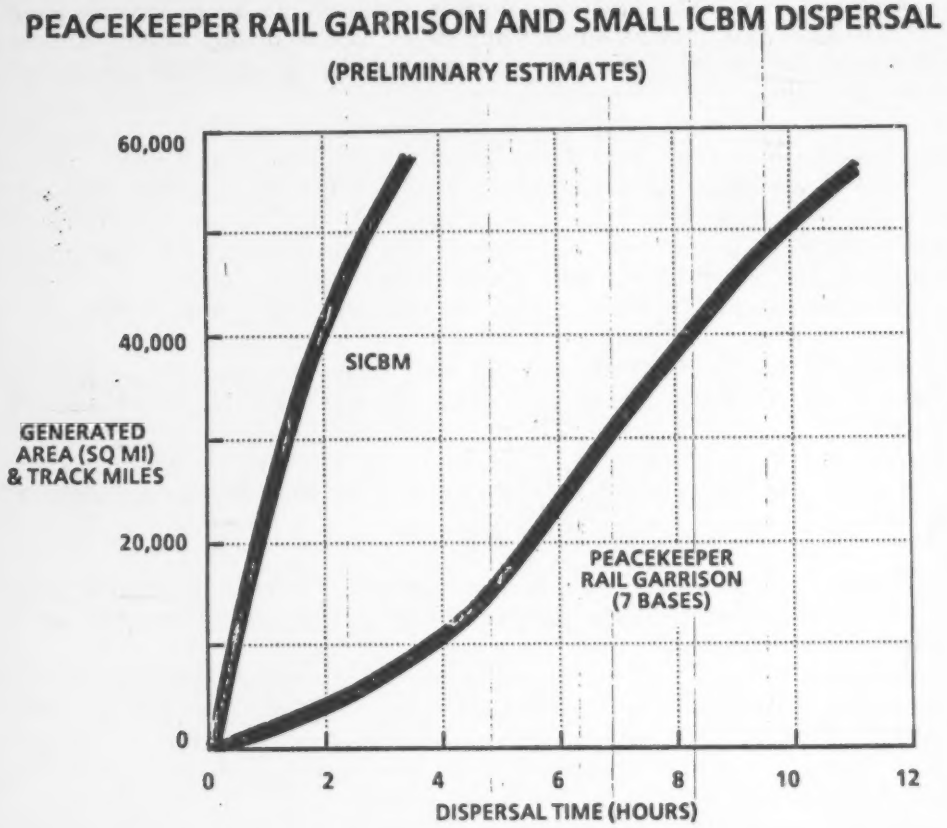
SOURCE OF FUNDS FOR RAIL-GARRISON MX

General May, is there any procurement money in fiscal year 1988 or fiscal year 1989 associated with the rail-garrison MX, or is it all R&D funds?

General MAY. Sir, I believe in Mr. Weinberger's posture statement he stated that he hoped that we would meet an IOC of 1991 and an FOC of 1993, and under that particular situation, he identified that 17 of the 21 missiles to be purchased in fiscal year 1989 would be purchased for deployment purposes.

At the same time, we recognize that the Congress has put a restriction on deploying additional Peacekeeper missiles in the 1986 authorization bill, and we are not asking for a deployment decision at this time.

Senator EXON. May I ask that this chart be placed back up on the screen [indicating].



We may go into this somewhat more in closed session. But I want everybody to take a look at this chart and I want to ask you gentlemen a question.

If—and I underline the word "if" because we don't know for sure—if we were assured of having up to 12 hours dispersal time—that's up to 12 hours, right?

Dr. WOODRUFF. Yes.

Senator EXON. If, for example, we had 24 hours warning notice of an attack—that chart and everything on it goes out the window. Is that right?

Dr. WOODRUFF. Well, I would just say that you go off the chart. Yes.

Senator EXON. Well, it wouldn't be meaningful, right?

Dr. WOODRUFF. Well, the areas are just much bigger if we continue to disperse outward.

Senator EXON. Now I am saying that you have 12 hours on there. If I understand it correctly, that anticipates that this would be the advantages, the pros and cons, for 12 hours. My statement is that if we had 24 hours, that chart would be meaningless.

Dr. WOODRUFF. All I am saying is that in 24 hours, if we wanted to, we would be out to areas like 100,000 square miles, or 100,000 miles of track.

Senator EXON. It seems to me—and maybe I am wrong—but it seems to me that you could say, therefore, that that chart would not mean anything.

General May, what is your response to that question?

General MAY. Sir, I agree with you. My response is once you get to those kinds of time periods, the only rational attack methodology for the Soviet planner is to go and find each one of those individual trains and develop what we refer to as strategic relocatable technology. One of the advantages of rail garrison is that it will force the Soviet planner, the Soviet resource allocator, to develop that kind of technology, and there is no imperative for him to do that today.

I also might mention that the Small missile portion of that chart would remain the same because we don't normally anticipate moving it out under other than tactical warning.

Senator EXON. But if we would go with the chart with that 24 hours notice scenario, that is beyond what we believe the Soviets have the capability, at least at this time, and in the foreseeable future, to address?

Senator MAY. Yes, sir. Not only does he not have the capability, but we don't think he would do that because it is so difficult to do.

Dr. WOODRUFF. In fact, most of the chart is that, it is true for that.

Senator EXON. Senator Thurmond, I am going to cut down on my time in the second round of questions. If we keep them short, we can go to a closed session.

Senator THURMOND. I have no further questions, Mr. Chairman, for this round.

Senator EXON. Thank you.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

WEATHER AFFECTS ON MOBILITY

Mr. Woodruff, I am interested in weather as it affects mobility. I don't know what kind of mudder the hard-mobile launcher is. If you get heavy weather that produces heavy mud, what does that do to mobility of the small-mobile missile?

Dr. WOODRUFF. You might ask this of the General also. But the Air Force recently told us that there would be a degradation of about 30 to 40 percent, in the area generation capability.

Senator WILSON. Which means that you don't achieve the curvatures on that chart.

Dr. WOODRUFF. Yes.

Senator WILSON. Which also means that there is a smaller area required for the Soviets to barrage. This means that it would require less of their inventory.

Have you actually figured it out? You are saying that you would get at least a 30 percent degradation?

Dr. WOODRUFF. I don't know. Has that changed?

General MAY. No, sir. That hasn't changed.

I might point out, Senator Wilson, that our calculations indicated if we could generate 10,000 square miles, that we would charge the Soviets the price to attack that we wanted to charge them.

Actually, in the Small Missile on Minuteman sites, we are able to exceed that and charge the Soviets a greater price to attack. And so, even though we experienced a 30 percent degradation, we went from approximately 15,000 square miles in a good weather situation to 10,000 square miles in bad weather. But that still caused the Soviets to use more RVs than we had allocated to this mission, which was, basically, his SS–18 inventory.

Senator WILSON. Well, let me ask this. Don't all of the uncertainties about the ability to achieve mobility that have been asked by Senator Gore and others apply to both modes of basing?

In other words, I can see some that apply to road mobility or off-road mobility that do not exist with respect to rail.

Isn't it true that all of these charts are really predicated on a flat, unimpeded surface, with, really, no problems in terms of hitting whatever your high speed is and not facing any obstacles?

General MAY. I don't believe so, sir.

I believe the figures we are using are based on a degraded situation. That is the way we put together the final recommendation to the Department of Defense and, ultimately, to the President.

We are confident that in a degraded situation, we could achieve the price to attack that I mentioned to you, or cause the Soviet planner to have to consider that. That is the important aspect to us, in that it enhances deterrence.

Senator WILSON. Let me ask you a question, then, that I have not seen answered in the charts.

The chart, you say that it envisions a degraded situation. I don't know precisely how degraded. But I can think of one use of missiles that could produce rather severe degradation.

SABOTAGE

I can think of sabotage that can produce severe degradation as well, I mean, not only to rail heads but to bridge heads, to roads, leading from the bases from which the dashes do occur.

Are you telling me that that chart reckons with all of those things?

General MAY. Sir, I don't believe that it reckons with such things as sabotage. Our basic reaction to the sabotage concern is that we think it is very difficult for the Soviet planner to come up with a plan that would allow him to sabotage our strategic forces across the United States. The triad itself provides us with a great deal of deterrent value against that kind of operation.

Sure, he could sabotage a bridge or a rail-garrison compound or bombers on alert today. But we don't think that is a very appealing scenario for the Soviet planner given the forces we have left that could quite possibly be used in retaliation.

"BOLT OUT OF THE BLUE" ATTACK

Senator WILSON. So you're not worried about sabotage.

How worried are you about a "bolt out of the blue" attack?

Can you answer that in open session?

General MAY. I will try to, sir.

First of all, by "bolt out of the blue," I assume you mean that there are no indicators that the Soviets are changing their day-to-day posture in contemplating an attack.

Senator WILSON. Yes. That is what that chart is all about, whether we are talking about 15 mintues or 3 hours or 12 hours—right?

General MAY. Yes, sir.

Under that circumstance, we think that the Soviet rational planner would calculate that he could do damage to us that would not be cost effective to him and would leave us with a very robust triad to respond against his value structure or against his home country.

We don't think a rational planner would make that kind of calculation, and, therefore, a "bolt out of the blue" is something that is certainly possible; but we don't feel it is something that, on a day-to-day basis, should be a major concern.

Senator WILSON. In other words, General, you think it is irrational?

General MAY. To conduct a "bolt out of the blue," in our judgment would be an irrational act. We do not today have a defense against an irrational act. As you know, deterrence is fundamentally based on rationality.

Senator EXON. Senator Levin.

Senator LEVIN. General, would you put up the chart again that you had before, the one with the two lines on it. I am not sure I understand how you get to your conclusions.

Can you tell from that chart——

Dr. WOODRUFF. May I ask something? If we could go into closed session, we could go into specific numbers on this chart.

Senator EXON. Well, we are going into closed session.

Senator GORE. He gave specific numbers earlier, though.

Senator LEVIN. Yes, he did.

I just want to know whether or not one can tell from that chart what percentage of each system is survivable after what period of time, of warning? Can you tell from looking at that chart?

My only question is can one tell from looking at that chart?

Dr. WOODRUFF. If one has the little key to the chart.

Senator LEVIN. The answer then is without that other key, you cannot tell?

Dr. WOODRUFF. That's correct.

Senator LEVIN. OK.

On the MX, if you could get 50 MX in fixed silos, 50 more MX in fixed silos, without the rail mobile, would you do it?

Dr. Woodruff.

Dr. WOODRUFF. Yes.

Senator LEVIN. General.

General MAY. That has been the Air Force position for a number of years, yes, sir. 100 Peacekeepers in Minuteman silos in accordance with the Scowcroft Commission Report.

Senator LEVIN. As I understand it, the reason that you are making this proposal is that you are unable, because of the Congress, or for whatever reason, to get the additional 50 MX in silos. Is that fair?

Dr. WOODRUFF. That's very fair.

Senator LEVIN. General.

General MAY. Yes, sir. As you recall, the Congress offered us the opportunity, when they capped Peacekeeper in Minuteman silos, to find a more survivable, mobile, concealable basing mode. In accordance with that congressional direction, we have come back to you with rail garrison.

Senator LEVIN. Was this particular mode considered in 1983 and 1984, when you looked at survivable basing modes?

Dr. WOODRUFF. To my knowlege, the rail garrison was not.

Senator LEVIN. General.

General MAY. It has been part of the last 18-month study. We started a study in July of 1985, after the cap legislation, and rail garrison has been part of that study during that time period.

Senator LEVIN. I made reference to 1983 and 1984?

General MAY. Sir, I am not aware of any studies that we were conducting then.

Senator LEVIN. So, as far as either of you know, until this recent requirement to look at this, rail garrison was never looked at as one of the alternatives for a survivable basing mode?

General MAY. Rail mobile has always been examined.

Senator LEVIN. Rail garrison has not been looked at.

General MAY. Yes, sir, but not garrison per se.

Senator LEVIN. Is that right, Doctor?

Dr. WOODRUFF. Yes. I agree.

Senator EXON. Let me break in for just a moment.

I wish you would check on that. It seems to me, with all of the studies that have been done on the MX over the years and what to do with it, I believe that there must have been some discussion at that time about running it on existing railroad lines.

I wish that you would check on that and make sure for the record that your answers are accurate.

Dr. WOODRUFF. Yes, we will do that.

[The information follows:]

MX MISSILE

The concept of rail mobile on commercial rail was investigated in considerable detail for Minuteman in the early 1960s. The concept called for deployment and dispersal over the rail net in the northwestern region of the U.S. Normally, trains (up to five missile cars) were to be parked at any one of several thousand sidings and then moved on a random basis. When parked, the train crew and locomotive were released; the missiles were erected to vertical and guidance was aligned. Variations of the rail mobile were examined in the late 1970s. One example was the Dedicated Rail concept which envisioned a new automated rail network of 22,000 miles laid in parallel lines four miles apart. Extensive land requirements included closing the land to public use to enforce safety and security. Through the many MX basing studies, however, the concept of basing in garrisons—with multiple trains stationed on military installations, and using existing security and support infrastructure—was never studied or suggested in any source documents we could find.

Dr. WOODRUFF. But, again, we looked at rail mobile in those days and not rail garrison.

Senator EXON. Well, you are making a big difference between garrison basing and new railroads.

Check that for the record, and I am sorry for the interruption.

Senator LEVIN. That is fine.

Dr. WOODRUFF. Again, putting the Peacekeeper on conventional railroads, and putting them out on the rail system were examined.

Senator LEVIN. Has there been some advance in rail technology since 1983?

Dr. WOODRUFF. No.

The difference here is going to a garrison concept and dispersing in times of need.

Senator LEVIN. Pardon?

Dr. WOODRUFF. And dispersing in times of crisis or need. That is what is different now.

Senator LEVIN. So there is no change in technology.

Dr. WOODRUFF. No.

Senator LEVIN. So the concept was available back then, but no one thought of it.

Is that correct?

General MAY. Yes, sir.

General Welch has testified in an apologetic fashion that we should have thought of this earlier, that this is a basing option, especially given the tremendous advances we have made in indicators and warnings, the tremendous expenditures of dollars to gather that information that allows us to make this recommendation today.

WARHEAD COSTS

Senator LEVIN. Can you give us the cost per warhead of the Midgetman compared to the cost per warhead of the D–5?

Senator WARNER. Do you mean the actual manufacturing costs?

Senator LEVIN. No. The same analysis—acquisition costs, life-cycle costs.

Dr. WOODRUFF. I would have to take that for the record.

Senator LEVIN. Also cost per alert warhead. I will raise it that way. Can you give us that?

Dr. WOODRUFF. Can I take it for the record?

Senator LEVIN. Yes.

[The information follows:]

D–5/SICBM COST COMPARISON

As the JCS answer indicates, through the Chairman's response, cost-only comparisons need to be qualified within the terms of overall effectiveness of the Triad. As the Chairman emphasizes, decisions on the President's Strategic Modernization Program cannot rest on cost alone.

By making a cost-per-warhead comparison, we know that MIRV'd missiles will always be less expensive per warhead than single warhead missiles. When comparing the D–5 with the Small Missile, we need to emphasize that the D–5 costs benefit from the fact that this system is well along in its development and large parts of the acquisition costs are already sunk. In contrast, the Small ICBM has just started development and the costs are preliminary estimates only. For a cost-comparison involving equivalent numbers (500) of alert warheads, Trident II (D–5) would require the acquisition and operation of four submarines (and corresponding support equipment) for a day-to-day posture of at least 500 warheads at sea. The Small Missile system cost estimates include the R&D, procurement, support and basing elements for deploying 500 missiles in 500 Hard-Mobile Launchers.

Shown below are costs for a 15-year life cycle in FY88 dollars. Department of Energy costs are not included. The Small ICBM cost range in the table reflects variations of estimates, for 500 deployed warheads, that depend on basing sites and operational concepts. The Trident cost is for four additional submarines on the margin of the procurement presently planned. The D–5 warheads at sea could be on patrol in defined areas or enroute between destinations. The Trident cost-per-warhead shown below is simply the total cost divided by 500 for reference.

PRELIMINARY COST ESTIMATES

	Total system cost		Cost per warhead	
	Life Cycle	Acquire	Life Cycle	Acquire
500 Small ICBMs	$44–48B	$37–39B	$88–96M	$74–78M
4 SSBNs Trident II/D–5	14B	8B	28M	16M

Senator LEVIN. Do you know whether or not it is roughly significantly cheaper one way or another?

Dr. WOODRUFF. Well, let's do it in life cycle. A Trident submarine with D–5 missiles, that's $3 or $4 billion; 200 warheads—no R&D now, I didn't put the R&D in that—so you can divide that.

Senator LEVIN. Well, you get 200 warheads, life-cycle, for about how many billion?

Dr. WOODRUFF. Three or four billion dollars.

Senator LEVIN. Three or four. So you get 400 warheads for $6 to $8 billion?

Dr. WOODRUFF. Yes.

Senator LEVIN. And with Midgetman you get 500 warheads for about $44 billion?

Dr. WOODRUFF. Subtracting out the R&D, which is about $12 billion or so.

Senator LEVIN. Well, the R&D has not all been spent yet, has it? Oh, you subtracted. The R&D has been spent on D–5 and has not yet been spent on Midgetman.

Dr. WOODRUFF. Well, whichever way you want to do the calculation.

Senator LEVIN. All right. Somewhere, depending on how you count R&D, the Midgetman is going to cost us between $36 and $48 billion for about 500 warheads, and a comparable number of D–5 warheads would be somewhere between $8 and $10 billion?

Dr. WOODRUFF. Yes.

Senator LEVIN. Thank you.

Senator EXON. For your information I have already requested the information from the NCS in a letter, the same question which Senator Levin asked you. So, if you would check with them, maybe you could save some time in finding an answer to that question.

We are winding down, now. I guess the next questioner would be Senator Warner, and then we will finish this second round and go into closed session with a recognition of Senator Gore after Senator Warner.

Senator WARNER. Thank you, Mr. Chairman. I have only one short question and then I will pass.

SINGLE WARHEAD SYSTEMS

On the current concept of single warhead systems, the Small ICBM, does that proposal for the carrier enable that carrier to be fully integrated with the interstate highway system and bridges?

General MAY. Sir, the answer is there will certainly be some restrictions because the road structure is not uniform throughout the country. Our effort is to make it as compatible with the day-to-day road structure as we possibly can, and there are some trades that

are going to be conducted during this early stage in FSD with the Boeing contractor, to make sure that we get it as mobile on the Nation's highway system as we possibly can.

Senator WARNER. Bridges are the principal choke point, are they not?

General MAY. Bridges are a choke point, and the narrowness of the road in some cases also presents a choke point, depending on the width of the vehicle.

Senator WARNER. And your design is moving toward the maximum integration possible, is that correct?

General MAY. That certainly is our intent, sir, and to understand the trade-offs involved in making it more or less so.

Senator WARNER. When will we know your decision as to what is the optimum carrier design and then what percentage of the interstate system would be usable?

General MAY. I assume at the critical design review for the hard-mobile launcher, sir. I am not sure when that is.

Dr. WOODRUFF. Probably in 1989.

General MAY. I believe it is next year, sir.

Senator WARNER. I want there to be no chance that we are going to awaken some day and be told that we cannot integrate this with the highway system. I want assurance that this is an extreme that is not going to happen.

One of the main reasons for my support of this system is its potential for breakout onto our interstate highway system.

Are you able to give me some reasonable assurance that there will be a measure of integration?

General MAY. In my judgment, there definitely will be. Yes, sir.

Senator WARNER. Could you quantify that to 50 percent of our system? Or 60 percent of our system?

General MAY. I would like to do that for the record, sir, if you don't mind.

Senator WARNER. All right. Don't just make it for the record, but let the counsel for the committee know. I want to know that answer as soon as possible, so just don't answer it for the record.

[The information follows:]

SMALL ICBM CARRIER

The Small ICBM Hard-Mobile Launcher (HML) design characteristics which affect compatibility with the interstate system will be determined soon after Preliminary Design Reviews (PDRs) currently scheduled to be completed by the first quarter of CY 88.

In the current concept of operations, interstate highway travel would only be used in crisis situations. The roadway capability of a HML prototype has been demonstrated. One trip was made between Yuma and Phoenix, AZ, over Interstate 10 and adjacent highways. The Arizona Highway Department conducted an analysis of the bridges and pavements and granted a permit. The vehicle axle load was 29,000 pounds, and a sufficient margin existed to support higher axle loads of about 38,000 pounds. This is comparable to the current HML concept. Also, a large number of passes were made on the base asphalt roads at the Yuma Proving Ground with vehicle axle loads of between 29,000 and 44,000 pounds. Post-test inspection revealed that no damage occurred.

The States regulate vehicle travel restrictions on federal interstate highways with requirements such as vehicle dimensions, maximum single-axle load, axle spacing and tire contact pressure for protection of pavements and bridges from structural damage. This damage normally results from a very high number of vehicle passes. Preliminary investigation of those federal highways available to support deployment

and operations of the HML on Minuteman launch facilities basing indicate that all pavements and most bridges are able to sustain a number of HML passes without damage (tens to hundreds of passes without significant damage). Because interstate highways in the potential Southwest U.S. deployment area were built to the same standards, we expect similar or better results there. Bridges with structural limitations can be avoided by preplanned alternate routing off the interstate system. The HML is not restricted by highway height or width clearances.

Senator WARNER. Thank you, Mr. Chairman.

Senator EXON. Just let me add to what Senator Warner just said.

Gentlemen, when we are talking about an emergency, we would not be out there surveying bridges to see whether or not it is safe to move this across.

Are you planning, if we develop this system for the Midgetman, that we would have practice runs of these vehicles without warheads running across the country? Or would the system work that these would not go out on the interstate system, ever, unless we were under warning?

Dr. WOODRUFF. It is my understanding that we would not take these out on the interstate system. We would have trainers that would go out for practice.

Senator EXON. Trainers, then.

General MAY. Either that, sir, or we will have training facilities on some of our main operating bases to train the drivers.

Senator EXON. Well, I thought we were going to have those people so well trained that they could go anywhere with this and do it. In other words, that has not been resolved.

General MAY. Finally resolved, that's right, sir. And, at the same time, as Senator Warner suggested, we are trying to make sure that we optimize mobility so that we can react to threats in the 21st century by moving these systems in a peacetime environment to another location if the Nation should choose to do that.

Senator EXON. Thank you.

We are glad to have Senator Gore with us today, and I will now recognize him for 6 minutes. Following that, we will go into a closed session for a brief period of time.

Senator WARNER. Mr. Chairman, before our distinguished colleague proceeds, may I just say a little something for the benefit of those in attendance?

When I look at the costs for these programs, the Midgetman, my support is driven by the potential that in a very serious breakout situation on the part of the Soviet Union, that we might be compelled to tell our citizenry that we have to interface this system outside of DOD-controlled land on an operational basis. And I want to make sure that the design of this system is such that if that eventuality does occur, we could do it. Hopefully, we could keep it contained within the military reservations for the foreseeable future. But I want to make sure. I don't want to wake up and have someone say my God, this launcher can't get across the first bridge outside of the base, and then we are all contained.

Senator EXON. Good point.

Senator WARNER. We could run computer models, we could run mock-ups down the road, we could do a variety of things. But we will know that answer.

I thank the Senator for his patience.

Senator EXON. Senator Gore.

Senator GORE. Thank you, Mr. Chairman. Thank you for your courtesy.

Senator Glenn has made the same points that Senator Warner has made. The point has been studied, and it can go almost anywhere. I think the answer for the record will confirm that.

But it is important to note that the Midgetman is capable of extracting this extremely high cost to attack, comprising more warheads than the Soviet Union currently has, by remaining on military reservations, and only in the case of some severe breakout of the kind postulated at some point in the future would the interface with the highway network ever be in prospect.

Also, I want to support the statements of Senator Warner earlier—and I mentioned this before—that we should not prematurely assume that the efficacy of this rail-garrison system has been proven. The R&D money is requested for finding the answers to those questions.

I raised in my earlier round some questions about some uncertainties that I want to get to for a minute. But, before I do that, I want to support Senator Levin's statements with respect to the chart that was used because I think the antenna of several staffers went up at the figures that you used. I would, again, submit this chart for my colleagues' attention, which shows that within 15 minutes, the Midgetman can generate enough area to require all of the Soviet SS–18s to destroy it, whereas the rail-garrison MX would require 3 hours to get the same cost to attack.

Now, the 3-hour figure depends on some assertions that contain a lot of uncertainties. Let me review those briefly for my colleagues who are here.

First of all, the witnesses have told us that each SS–18 can destroy 40 miles of track. All right. They are assuming, presently—and it is understandable, because the R&D really has not been done. These are sort of back of the envelope calculations, and I am not charging any sloppy work at all. I am just saying that we ought to look at these uncertainties.

I would provide for my colleagues the results of some extensive work done by my staff, which identifies each of the bases where these rail-garrisons would possibly be located, and then more detailed blow-up maps of the rail networks flowing out from every single one of these potential bases.

What these maps show is that in many cases, the rail networks flow through Minuteman bases that would be subject to attack in any event, and if you had the line mapped out and you knew exactly where it was and the Soviets were already allocating saturation warheads to that area, then you don't get that benefit.

Second, when you talk about 3 hours of rail time, you may go from Little Rock to Memphis in 3 hours. And so, you are not going to tell the American public that part of the refuge area for rail-garrison MX is to hide it in downtown New Orleans or in downtown Detroit. Some of the rail lines run directly into cities.

Another uncertainty is that the rail beds in many instances will not allow heavy trains of this kind to go over them. That has not yet been taken into account, and it should not really have with the time periods you all have been constrained to work in.

The speed of the train is something that is a major uncertainty.

Also, you have the sabotage scenarios which were referred to briefly earlier.

Now, I believe that the approach that my colleague from Virginia has suggested makes a great deal of sense, and let me just conclude with one other point. Again, this was referred to by the Senator from Michigan.

If you assume that strategic warning is no longer necessary, then there is a completely different world.

But, Mr. Chairman, and I say this for the record and as part of the dialogue that we are having here, there are situations where a crisis occurs, and the tension builds and the very act of rolling these missiles out of the garrisons onto the rail network becomes itself part of the crisis. If they are vulnerable in the first hour or 3 hours and the Soviets know that if they let them roll for 5, 6, or 7 hours they escape, then there will be a temptation in the midst of the crisis and extreme tension to get them while they are vulnerable, during that 3-hour window, which may in any event be much larger, depending upon how these assumptions come out.

Mr. Chairman, you are very, very courteous. I would ask the witnesses if they would like to contest my summary of the acts in any particular?

General MAY. Senator, I might make one comment.

On the last point you made, it is our judgment that the Soviet planner has to calculate at all times that Peacekeeper missiles, whether in silos or in rail-garrison, are available to be launched.

Senator GORE. Right.

General MAY. And it does not really change the situation if we move those trains out on the track. They are no more available for launch on the track than they are in the garrison.

Senator GORE. But they are less vulnerable to Soviet attack, and if the Soviet planner doesn't know how the crisis is going to evolve, it may reach the boiling point right around that time, and he is looking at two choices. Either he can wait and let it evolve another 6 hours, in which case he cannot get them; or he can take advantage of the opportunity that occurs at the time they start rolling, and he can get them.

The launch on warning hedge is present with every single system that we have, and one of the things we try to avoid is forcing either side to go to a launch on warning scenario. So, yes, that is a hedge, and it weakens any case that you make on any system.

Dr. WOODRUFF. My only comment is that the dispersal of the system is in our control. At very low levels of warning with this particular system, we could go out on the rails, and basically do it before we got to the level of crisis that you are describing. We have the flexibility.

General MAY. In fact, we argue that it does not require strategic warning. It requires that the President of the United States or his duly designated subordinates make that decision and put the train out on the track because that particular day, it was his judgment or her judgment that that was the best way to handle the national need.

Senator WILSON. Mr. Chairman, before we go into closed session, I would like to ask for the record, from the Air Force, the cost of the switch at whatever time they view it as necessary from the

present siting proposed, the Minuteman siting at the Western reservation.

General MAY. I would like to provide that for the record, sir, to give you accurate data.

Senator WILSON. Fine.

[The information follows:]

COST OF MINUTEMAN SITING

The military construction costs for deploying 500 missiles on three existing Minuteman bases (Malmstrom AFB, MT, F.E. Warren AFB, WY, and Ellsworth AFB, SD) is $1.9–$2.0 billion (FY 84 $). If, for example, deployment of Minuteman is stopped after two bases and the remaining missiles are deployed at one Random Movement Complex (RMC), i.e., Texas/New Mexico, the delta military construction costs for deleting one Minuteman base and adding the RMC are estimated at about $0.2 billion (FY 84 $), for a total military construction cost of $2.0–$2.2 billion (FY 84 $). Note that Minuteman basing takes advantage of the Strategic Air Command base infrastructure already in place. Since the base infrastructure is not available at the RMC, they must be developed from scratch.

Senator EXON. Thank you all very much.

We will now go into closed session. I would ask the staff to make sure that the room is properly cleared.

[Whereupon, at 12:29 p.m., the subcommittee recessed, to reconvene in executive session.]

EXECUTIVE SESSION

The subcommittee reconvened at 12:31 p.m., Senator J. James Exon (chairman) presiding.

Senator EXON. We will proceed now and we will limit our questions in this round to 3 minutes each. We will go to a second round if necessary, because we have another hearing coming up this afternoon and I know you gentlemen have other responsibilities.

We are of course all pressed for time. I just want to thank you for your very forthcoming answers. I would like to say, gentlemen, that some of the information that you have been asked to submit for the record would be particularly helpful if it came to us before a final markup.

So I would like to request that you make every effort to answer the questions submitted for the record within 2 to 3 weeks at the outside, if that is possible.

"BOLT OUT OF THE BLUE" ATTACK

We cannot go to complete Codeword classification. So recognizing that, let me just ask this. Given the information that we received in earlier testimony today, would you agree that a "bolt out of the blue" attack is an irrational and unrealistic act? Is that what you said?

General MAY. Yes, sir. Going through the calculation, sir, that in our judgment there is no benefit, or the costs to the Soviets outweigh the gains, that they would not make a decision to attack us without generating their airplanes and more of their submarines and providing us with the indicators that we would not get in a "bolt out of the blue."

Based on that, that there is no advantage to the Soviets to conduct that kind of attack, then it seems to us that the only time

that might occur would be if an irrational decisionmaker were in charge.

BUILDING TWO MISSILES

Senator EXON. General, let me ask this question, and I will ask it of you also, Doctor. It seems to me that all of these considerations we are going through now, of building two missiles is unaffordable given the budget constraints that we have.

And General, I certainly feel that there is a deep feeling that the Midgetman is not necessary as far as the Air Force is concerned.

Doctor, I know first-hand that that feeling is prevalent in the highest echelons of the Department of Defense today. If that is true, and I think it is, then why are we going ahead with this proposal?

Dr. WOODRUFF. Well, I think it has already been stated. Congress is requiring that we go forward with the Small Missile. The Air Force has made an argument that there is reason for those warheads, and there is the synergism argument that Senator Gore mentioned, that the Small Missile is needed for the unlikely case of limited or no warning.

So for all of those reasons, we are going forward with the Small Missile.

Senator WILSON. I am sorry, I could not hear that. Would you repeat that?

Senator EXON. Yes, please repeat that, and speak a little louder.

SMALL MISSILE

Dr. WOODRUFF. I said there are three reasons why we are going forward with the Small Missile: One, Congress has requested we do that; two, the Air Force has requested those additional warheads, they need those warheads for the SIOP; three, there are synergisms between the Peacekeeper rail garrison and the Small Missile in hard-mobile launchers, that Senator Gore has talked about, for the unlikely scenario of limited or no warning.

Senator EXON. Which is very unlikely.

Could you just give us your personal opinion, each of you, that if you were sitting on this side of the table instead of over there (indicating), given the budget constraints that we have and measuring where the funds could be used elsewhere, you would recommend that we proceed with the Midgetman? Or do you think the money could be spent better elsewhere in our national defense?

General MAY. Sir, I believe the Air Force made the tradeoffs in the budget cycle. We made some hard decisions to keep the $2.2 billion in 1988 and the $2.2 billion in 1989 in our program. It is fully funded in the President's budget submission; it is fully funded in the out years.

Senator EXON. I am not sure that is responsive to my question. I will give you a chance, Dr. Woodruff.

Dr. WOODRUFF. I am not sure I am going to be responsive either. That is not our decision.

Senator EXON. I know that. But it is mine. My time is up. Senator Thurmond.

Senator THURMOND. I think that is a very important question and I wish you would answer it.

Dr. WOODRUFF. My personal view?

Senator THURMOND. Yes.

Dr. WOODRUFF. My personal view is the money would probably be better spent on the larger missile, the Peacekeeper, instead of on the Small Missile.

Senator THURMOND. You think the money would be better spent on the larger missile, the Peacekeeper, is that right?

Dr. WOODRUFF. Yes.

Senator THURMOND. Instead of the Midgetman?

Dr. WOODRUFF. Yes.

Senator THURMOND. General, would you give us your personal opinion?

General MAY. Sir, I think to have the optimum deterrent strategy going into the 21st century, we need to have a single RV missile and we need to have some of those missiles that are survivable under tactical warning to provide us with maximum or optimum synergism. I think we need a Small Missile system, and the basing option is something that is open in my mind.

Senator THURMOND. You have got so much money. The question is, can you better spend it with the Peacekeeper or should you divide it with the Midgetman?

General MAY. I think under the program that we have right now, given the targeting problem that we have, if we were able to get 50 Peacekeeper in Minuteman silos, 50 in rail garrison, and the appropriate number of small missiles, we will have the best triad within a triad to go into the 21st century.

The tradeoffs, as I indicated before, have already been made by the Air Force. How we will trade off next year and the years beyond, I am not going to predict. But we did meet the hard tradeoffs and gave up some force structure and gave up some other kinds of opportunities in order to fully fund the Small Missile.

Senator THURMOND. Well, if you were starting from scratch and had your choice of more Peacekeeper missiles or the Midgetman missiles, which would you take?

General MAY. The Air Force's first priority has been to have at least 100 Peackeeper missiles in the inventory.

Senator THURMOND. That would be your first priority?

General MAY. Yes, sir.

Senator THURMOND. Thank you.

TACTICAL WARNING SHORTFALLS

Senator EXON. I will recognize Senator Wilson, but would first like to follow up on your response to Senator Thurmond. General, you have said that it is absurd to expect that we would not have something more than tactical warning. And then you turn right around and say, but we need to spend $40 to $50 billion on the Midgetman missile because of shortfalls in tactical warning.

Is that not the spot that you are in with your answers to these questions?

General MAY. Perhaps so, sir. But what I was trying to indicate is that even though we are very confident that we will have warn-

ing indicators to tell us something is happening in the international environment with respect to the Soviet Union, there is still the other probability that the Soviets will make an irrational decision.

Senator WILSON. The probability?

General MAY. I think there is a probability, sir. It is a small probability that that would happen.

Senator WILSON. Well, then I would not think it is a probability, General. It is a possibility that they would make what you characterize as an irrational decision. I do not think it is a probability.

General MAY. All right, sir, a possibility that they would make an irrational decision.

Senator THURMOND. Well, which is it you are saying, a probability or a possibility?

Senate GORE. He means a small probability.

Senator EXON. I think he means possibility.

Senator THURMOND. Well, I am asking.

General MAY. I think there is very little chance that the Soviets would make that kind of decision. But at the same time, I think our optimum posture in the 21st century would be to have Small Missiles, because we do not know what kinds of challenges we face. Certainly there are technological responses to any new system, and in order to put ourselves in the best posture to go into the 21st century, in spite of the fact that we have great confidence in rail garrison today, we ought to have a single RV system in the inventory other than the Minuteman II, which is old. We ought to continue to develop the hard mobile launcher for those potentials in the 21st century.

That is my personal judgment.

Senator EXON. I will recognize Senator Wilson for 3 minutes.

Senator WILSON. Thank you, Mr. Chairman.

I think you have asked the critical question. I think the answer to the critical question is clear from the record. The justification, and really the only justification, that has been presented this morning for spending $40 to $50 billion on the Midgetman, on the Small Missile system, is to provide a response to a "bolt out of the blue" attack, which General May has, I think correctly, characterized as being so improbable as to be irrational, or so irrational as to be improbable.

CARRY HARD SYSTEM

Let me ask this, though. Let us just assume that they make such a decision, that there is a concern with a "bolt out of the blue" decision that is greater than you have indicated today. Is there not an MX solution to that problem, and is it not called Carryhard, and what does that cost?

Dr. WOODRUFF. Yes, two Carryhard systems were considered and, if I remember right, in the same number of missiles, the same timeframe, I think the cost was about $25 billion.

Senator WILSON. Would that not give you every bit as much tactical assurance?

Dr. WOODRUFF. On the tactical assurance, yes.

Senator EXON. In fact, would it not give you a whole lot more, because then you would not have to be concerned with what the

weather was like or what the problems were in terms of impediments to mobility?

Dr. WOODRUFF. You would pay a price relative to the flexibility of the Small Missile.

Senator WILSON. Let me ask this final question. It really relates to a different system, but it is a related problem. In all of the investigations that I have made of SDI, I have encountered people who were quick to say, but we can be overcome because there are always things that the Soviets can do to defeat us.

FAST-BURN LAUNCH

Specifically, with respect to a boost-phase element, they can defeat that by the simple expedient of going to a fast-burn launch.

Now, if it is supposed to be so cheap and easy for the Soviets, are we developing a fast-burn launch capability?

Dr. WOODRUFF. My response is——

Senator WILSON. My question is, just how cheap and easy is it?

Dr. WOODRUFF. I cannot answer that. We have done concept studies on fast-burn boosters—just concept studies to my knowledge.

Senator WILSON. Why are we not doing just more than concept studies?

Dr. WOODRUFF. I do not have an answer to what the cost would be.

General MAY. I do not either, and we will have to submit that for the record.

[The information follows:]

COST OF FAST-BURN LAUNCH

Exact cost figures are not available for the development of a fast-burn launch program for ICBMs because we do not intend to enter into development of this concept at this time. We believe the development costs would be considerable since a fast-burn booster would not be a simple evolution of propulsion technology but could extend the state-of-the-art. Even if we began development now, such a fast-burn booster would not be available until at least the mid-90s or beyond. The advantage of fast-burn technology is that it shortens the time an ICBM is in boost phase and, therefore, complicates the ability to track, target and intercept the booster with space-based weapons. This, then, also allows the release of reentry vehicles earlier in the flight, so that space-based anti-missile systems would have multiple targets to contend with, rather than a single missile.

Senator WILSON. Well, I wish you would begin to do the work. I think Dr. Woodruff has candidly indicated that we have done nothing more than look at the thing in terms of concept, and these glib assertions that it is so fast and so easy and so cheap I think are subject to great question, and I would like to raise that question for the record.

Senator EXON. Under the committee rules, Senator Warner is recognized.

Senator WARNER. Thank you, Mr. Chairman. I have no questions.

Senator EXON. Senator Gore is recognized for 3 minutes.

Senator GORE. Thank you, Mr. Chairman.

I think we ought to explore in this afternoon's session the definition of that word "unlikely" and whether or not there might be reasons to hedge against a threat scenario even if it is calculated to be unlikely. The word "irrational" was also used in connection with short-warning time scenarios.

Well, nuclear war is irrational in any scenario that you can imagine, and yet we still plan against the contingency. The fact is that small probability attack scenarios have political significance as well as military significance. They also have psychological significance, and they have driven this country and the Soviet Union toward many military building programs over the years.

The so-called "window of vulnerability" for all these years has really been based on a small probability scenario from the very beginning.

Fourth, the fourth point I would like to make briefly, Mr. Chairman, is that the choice is not between 100 MX missiles and a mix of MX and Midgetman. We have in this country a democracy, which requires a consensus for forward movement in programs like strategic modernization. It is just a fact that the House of Representatives is not going to approve additional MX missiles, maybe under any circumstances, but certainly not if the Midgetman program is killed.

There have been great efforts in the past several years to try to put together and maintain a bipartisan consensus on strategic modernization. The Air Force, if I might say, General May, has been supportive of those efforts and has recognized the value of consensus in our country and other matters.

The Office of the Secretary of Defense, if I may say, has consistently undermined the consensus that was built in the aftermath of the Scowcroft report.

NECESSITY OF ICBM MISSILE DEFENSE

I have one final question before my colleagues leave. Is it your view that either one of these systems requires ICBM missile defenses in order to survive?

General MAY. No, sir. The design of the mobile system is basically insensitive to the requirement for the defense as we know it today, at least point defense.

Senator GORE. Thank you.

Senator WILSON. Mr. Chairman, may I ask another question?

Senator EXON. Certainly.

Senator WILSON. If they do not depend for survivability, would they not be enhanced?

Dr. WOODRUFF. Yes.

Senator WILSON. Thank you.

Senator GORE. In a rational or irrational way?

General MAY. In a costly way, sir.

Senator EXON. We will reconvene at 2 o'clock again in this room.

I want to thank both of our witnesses. You have been very helpful. Thank you for coming, and we are adjourned.

[Whereupon, at 12:48 p.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

FRIDAY, MARCH 6, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

ICBM MODERNIZATION ISSUES

The subcommittee met in open session, pursuant to notice, at 2:05 p.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Levin, Gore, Warner, Thurmond, Humphrey, Cohen, and Wilson.

Staff present: Patrick A. Tucker, minority counsel; Gerald K. Bankus, Robert F. Bott, William E. Hoehn, Jr., Ronald P. Kelly, professional staff members; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Milton D. Beach, assistant to Senator Glenn; Donald A. Mitchell, assistant to Senator Glenn; Leon Fuerth, assistant to Senator Gore; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT BY SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order.

The subcommittee meets this afternoon, and we will be in open session. There will be no closed session in our proceedings this afternoon.

This afternoon, the subcommittee meets for its sixth hearing on the fiscal years 1988 and 1989 defense authorization request.

We had a most useful session this morning on the strategic warning system and also on the administration's rationale and programmatic request for ICBM modernization.

Both of our witnesses this afternoon are former DOD officials. They are widely recognized experts on ICBM modernization. Both have participated in the executive branch activities and studied requests by the executive branch, and both have written on the various issues of ICBM modernization.

First we have Donald A. Hicks, who, until last August, was the Under Secretary of Defense for Research and Engineering, until

that position was abolished by the Defense Reorganization Act that I and many others supported. We are still confident that that was a very good move.

Indeed, though, and as an aside, many of us feel that the administration made a grave error in failing to select Dr. Hicks to be the first Under Secretary for Defense Acquisition.

During his tenure, he was involved in the early stages of the ICBM mobilization review, including an evaluation of the costs and mobility tradeoffs from the increasing number of warheads on the small IBCM or Midgetman as well as candidates for the MX basing system.

We welcome you, Dr. Hicks, and look forward to your testimony with great interest.

Our second witness also is no stranger to this committee by any means. James Woolsey is a former Under Secretary of the Navy, and I should note that he never tried to interfere with the Navy's officer promotion system. That is one of the outstanding things that you did during your service over there, Mr. Woolsey.

Mr. Woolsey was an advisor to the original SALT negotiations and a member of the Scowcroft Commission which set forth, back in 1983, the general outline for the ICBM modernization program that is underway today.

He has continued to analyze ICBM issues since that report was issued, and has been active in and a contributor to that debate.

We also welcome you, Mr. Woolsey, and we look forward to your testimony also.

I intend to have both witnesses offer testimony before we go to questions by the subcommittee.

When Senator Thurmond comes in, we will recognize him without interfering in either one of the statements that you are about to make. He may have some opening remarks that he would like to make as the ranking minority member of our subcommittee.

With that, I recognize Mr. Hicks. Please proceed with your presentation.

STATEMENT OF DONALD A. HICKS, FORMER UNDER SECRETARY OF DEFENSE FOR RESEARCH AND ENGINEERING

Dr. HICKS. Thank you, Mr. Chairman, and gentlemen.

It has been nearly a year since I last appeared before this subcommittee, and I appreciate your invitation to appear again.

On my last appearance, I discussed this administration's ICBM modernization program. Since my responsibilities were in the area of the performance and cost-effectiveness of those systems, which would result in a credible deterrence, I asked the support of this subcommittee in having the Air Force carry out additional technical studies that were required before credible decisions could be made on the correct MX basing mode or the proper SICBM configuration.

These studies now have been carried out and you have been briefed on these results.

While I am not overwhelmed with the adequacy of these studies, I believe that the important decisions can now be made and certainly the administration has come to that conclusion.

I must say that I am not in agreement with some of the major aspects of those decisions.

I should bring out that I have a major philosophical difference with my friends, Brent Scowcroft, John Deutch, and Jim Woolsey, that color my personal conclusions. I find that the "bolt out of the blue" threat is not credible. All of our deterrent forces depend upon a rational enemy. No Soviet planner in his decision-making can really depend upon our not launching early enough in his attack so that most of our land-based ICBMs would remain an effective offensive force.

Additionally, 30 percent of our bomber force and 50 percent of our SLBMs will be able to carry out their offensive missions, even if the Soviets were successful.

As a result, I am less concerned about survivability of the force than that we have sufficient offensive capability to hold their forces hostage as they do ours, to serve as a credible deterrent.

Therefore, I support the garrisoned rail-mobile system proposed by the administration. I believe that we will have sufficient strategic warning to deploy it properly. It has its weaknesses, but I am not concerned by them.

However, I cannot support the decision to develop the small ICBM system. If we were unconcerned by the need for funds, it might be appropriate to proceed. Even then, I have some disagreements with the approach the Air Force has taken in its basing decisions to conserve funds. But, with our overall needs, it seems difficult, to me, to justify its priority.

I am sure that if the Air Force were required to list the importance of a number of key programs, including the advanced tactical fighter and the ATB, the SICBM would be last.

Of course, the garrisoned rail-mobile system would, and should, be high on the list. Even in the strategic area, the SICBM money could be better spent in the connectivity area, particularly in the communications with our ICBM fleet.

While I have been told many times of the political impossibility of another approach, I feel obligated to discuss it with you.

Even if, in its wisdom, Congress decides that system survivability equivalent to the SICBM is required, there is a much more cost-effective approach.

While the Defense Research Science Board's Deutch Panel dismissed the so-called Carryhard basing mode for the MX missile, Fred Ikle, and I, at that time, expressed our reservations about this conclusion, since the costs of the deceptive silos were in question.

I am told that the Air Force study that has taken place over the last year has found these costs much less than assumed by the Deutch Panel, and that the overall systems cost would be one-half to two-thirds of the cost of an equivalent 500 RV SICBM system.

As a result of its recent decisions, the administration has stopped efforts on the Carryhard basing mode. I believe prudence suggests that these studies continue.

Mr. Chairman, that concludes my remarks. I will be pleased to answer your questions.

Senator EXON. Thank you very much.

Mr. Woolsey, before you proceed, I would like to recognize Senator Thurmond, who was briefly delayed.

I would like to call upon him now for his opening statement.

Senator THURMOND. Thank you very much, Mr. Chairman.

I just want to say that I want to join you in welcoming back Dr. Hicks and Mr. Woolsey to the subcommittee. Mr. Woolsey has been around here for a long time. We have known him from many years ago.

Dr. Hicks, Mr. Woolsey, I want to thank you gentlemen for taking time out from your busy schedules to be with us this afternoon. I look forward to receiving all of your views as private citizens on the President's ICBM modernization program that was the subject of our hearing this morning.

As one Senator who has concerns about our ability to afford the overall ICBM modernization program in view of other strategic and conventional force priorities, I am especially interested in hearing the views of you gentlemen. I am sure they will be very helpful to us.

I am also interested in hearing your views regarding the departure from the traditional view that ICBMs should not be dependent on strategic warning for their survival.

Thank you very much, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond.

Mr. Woolsey, please proceed.

STATEMENT OF R. JAMES WOOLSEY, FORMER UNDER SECRETARY OF THE NAVY

Mr. WOOLSEY. Thank you, Mr. Chairman.

I always feel when I am in this room that if I sit out here, I am on the wrong side of this table. I should be back in one of those staff chairs, where I was for 3 years.

Senator COHEN. Actually, we thought you were referring to sitting on our side of the table.

Mr. WOOLSEY. Oh, no, Senator Cohen. Washington lawyers never presume to that.

I think that it is important to note that there are really two roles for the ICBM in modern American strategic thinking. One is as a prompt hard-target killer. This, I think, is a necessary function for the ICBM force to serve. It is one that is somewhat in transition, as a result of the Soviet move toward mobility, but, nonetheless, for a considerable period of time it will be an important part of deterrence. It is one of the reasons why I support not only the D-5 and the MX, but the hard-target kill capability for a small missile as well.

I want to talk a little bit more, though, about a second important role, which I think is more deeply related to the role of the small mobile ICBM, and that is the role of providing a hedge, essentially, against Soviet improvements in anti-submarine warfare.

We have gone though a period of some years now in which—although we thought in the 1960s, ICBMs were going to be survivable for a long, long time, and we initially thought of the submarine force as something of a modest adjunct to the ICBM force—we found that with Soviet improvements in accuracy and yield, it has become necessary, during the 1970s and 1980s, to be very happy—let me put it that way—that someone made a decision back in the

late 1950s to move toward having a survivable ballistic missile force at sea. The submarines have provided a survivability that was very much in question with respect to the ICBMs during this period.

If we look to the future, we are embarked on a program for our ballistic missile submarine force of, presumably approximately 20 ballistic missile submarines out into the 21st century, perhaps two-thirds at sea at any one time. Without survivability in the rest of our strategic forces—ICBMs, bombers, or both—we are betting a very great deal on the survivability of 12 very large platforms at sea, each about the size of a World War II cruiser.

Now, I believe that the survivability of submarines in the open ocean for a long period of time is likely to be quite good, particularly as long as they can "run silent and run deep," as the old phrase goes, and as long as there are decent communications with them.

But, I believe that once we are in an era in which Soviet ballistic missile and cruise missile firing submarines, armed with advanced, perhaps stealthy submarine-launched cruise missiles and perhaps—and this is not that hard to do—depressed trajectory SLBMs can come relatively close to the shores of the United States, then we have a strategic problem that it is well for us to face now.

Under those circumstances, we are thrown back into very heavy reliance for a survivable strategic force on those 12 large underwater cruisers at sea. This is because, with MIRVed accurate SLBM's relatively close to the United States, with a combination of those and SLCMs, the Soviets could, simultaneously, launch an attack within minutes upon our command and control and communications, our bomber bases, and our fixed ICBMs, whether those ICBMs were perpetually fixed, as in silos, or only temporarily fixed, as in rail-garrison igloos.

Trying to solve these two problems for the ICBM force—trying to make a single missile with a single deployment mode both a prompt hard target killer with effective numbers in a cost-effective way, and survivable across a full range of attack scenarios—has simply proven too difficult.

We looked into this thoroughly on the first Townes Committee, on which I served, the Scowcroft Commission, the Deutch Committee—all three. I believe that the beginning of wisdom with respect to dealing with the U.S. ICBM force over the long run is to admit that trying to recreate Minuteman in its heyday, a system with low operating costs, very good survivability, accuracy, prompt and effective command and control, with a single missile in a single basing mode is over. Those days and that type of solution are no longer open to us.

Soviet strategic force improvements have simply made it impossible.

Now, the difficulty of finding solutions to the problems of ICBM survivability and effectiveness, together, led to efforts outside the ICBM program to deal with this difficulty. We have tried to deal with it through arms control. I have been either an advisor or a delegate to three of the four sets of strategic offensive negotiations we have had with the Soviets since 1969, and I would say that, with respect to negotiations over strategic offensive forces, something on the order of three-quarters of our time, concern, and effort

has been spent on the ICBM survivability problem. And we had sat there, year after year, and in one way or another tried to bring leverage to bear on the Soviets, to cajole the Soviets, to persuade the Soviets to help us with the survivability problem of our ICBMs, based at fixed points on land. They have smilingly negotiated with us and for 18 years cheerfully made the problem worse, while they were negotiating with us.

It is one of the main reasons, if not the principal reason, for the dissatisfaction that has existed in one way or another with respect to the SALT I agreement, the SALT II agreement and the current lack of agreement with respect to strategic offensive weapons in the START talks.

The focus on the need to preserve ICBM survivability against a sudden Soviet attack has also had an impact, I think a very important impact, on the SDI debate. This is because the unique capability of the Soviet SS–18s, on which we concentrate so heavily, is their ability to attack hardened targets, such as ICBM silos or shelters.

We have certainly many things to be concerned about with respect to Soviet strategic offensive forces and the SS–18s, in particular; but, generally speaking, that is their unique capability.

This has led us, in turn, to concentrate heavily on boost-phase intercept of MIRVed Soviet ICBMs as a major focus of the SDI program. I do not believe this concentration on boost-phase intercept of large, MIRVed Soviet ICBMs is due to any inherent nature in large, MIRVed Soviet ICBMs. It is the combination of the existence of those Soviet forces and our own vulnerability of our ICBM force that has driven us to concentrate so heavily on this particular strategic problem.

I would add that I believe there are other problems, military problems, strategic problems, for the United States, which may require significant work with defensive systems, and that those may involve—we could get into this during the questions if one wants, but let me just briefly mention them—those might involve defense in Europe, or perhaps elsewhere, against Soviet or Soviet Bloc tactical ballistic missiles. They might also involve, as far as the continental United States is concerned, defense of our command, control and communications and the nonalert portions of our strategic forces against Soviet submarine-launched missiles, both ballistic and cruise.

If we were free to deal with the problem of the SS–18 threat against our ICBMs by some method other than defensive systems, if we were free to deal with that, for example, by moving toward mobility, effective mobility across a whole range of scenarios for our ICBM force, I believe this might free us to concentrate on some other aspects of defensive systems, problems that in many ways I think have no solution other than reliance on defensive systems.

A solution to the ICBM vulnerability problem across the range of scenarios under which the Soviets could attack or threaten attack is, I think, somewhat like the keystone or the arch of our strategic programs. If you put that solution into place, it makes a lot of other things much easier. It holds them in place as well.

If you leave that keystone out, the whole system becomes, as far as I am concerned, unstable.

Now, I believe, as a general matter, the solution to the ICBM survivability and modernization problem which the Air Force has presented to you is a sound one. I believe that rail garrison is probably a reasonable way to go to base whatever MXs the country decides to acquire, whether it is the second 50 MXs or, in time, all of 100 MXs, or, if the Congress decides only to acquire 50, perhaps in time those 50 MXs.

It seems, comparatively speaking, to be of relatively low cost. It does not interfere with current base operations. And, although I have not had an opportunity to study it thoroughly and would want to do that before giving a complete endorsement, I believe, generally speaking, that it is a sound approach.

But it does require strategic warning of several hours in order for it to be survivable.

Consequently, I do not believe that a rail-mobile or rail-garrison system can stand alone as a hedge, an important and I think needed hedge, against potential Soviet improvements in anti-submarine warfare over the long-run.

Alone, buying a rail-garrison MX, to me, is somewhat like buying a new bomber force that cannot be put on alert in peacetime, or a new submarine force that, for some reason, must stay in port in peacetime.

I believe that with the small mobile ICBM, a rail-garrison MX is a reasonable, nonalert, but alertable portion of the ICBM force for the future. I see those two systems together as being the alert and nonalert portions of a force, somewhat the way submarines at sea and submarines in port are the alert and nonalert portions of the submarine force, and bombers on strip alert and bombers not on alert are the two portions of a bomber force.

The small mobile ICBM I believe is useful, although expensive, for prompt use, for alerted use with increased survivability, or as an enduring force that could survive in the continental United States after a Soviet attack. But its unique feature and what you would be paying for it you decided to acquire it is its excellent survivability against the full range of threats, including particularly sudden attack.

The question will come to your mind: what about probabilities? Can't we do a statistical analysis of the future and decide what is more likely and what is less likely?

Can't we decide, as Dr. Ikle and others have said, that it is unlikely that we would need to use ICBMs, except under circumstances in which they can be generated—a war in Europe, let's say, or a strategic crisis, such as the Cuban missile crisis.

I must say that in this context, I do not believe statistical calculations about the future are the path of wisdom. I believe this is more a problem similar to a game of chess for the Soviets, in which one has a potentially serious gap in one's defenses and it simply needs to be filled.

As far as the small mobile ICBM program is concerned, I would have a preference for the Southwest basing, as we said in the Deutch Committee report, and I very much believe at least one Southwest base should be included in the program from the beginning.

But the key thing is that the small size of the 37,000 pound mobile ICBM provides flexibility for later deployment to other parts of the country, whether on the road system or to wooded areas on other military bases if the Soviets should develop some particularly advanced threat, such as real-time reconnaissance and targeting, and, furthermore, that flexibility and that survivability puts the Soviets into a particular set of difficulties with regard to trying to plan an attack, a successful attack, on U.S. strategic forces as a whole.

As far as strategic warning goes, it is my conviction that there is a big difference between strategic warning, as it might be urged by military commanders, and the implementation of steps in response to those urgings as it might be practiced by a president with the advice of the National Security Council in time of crisis or war.

In order for a military commander to urge that military systems be generated—submarines be moved out of port, bombers be put on airborne alert, igloo-based MXs be put on the rail system—he does not need and sometimes may not assess the impact on the other side, intentions, the nature of the crisis, the political signal which is given. A presidential decision is different than a general's decision in those circumstances.

We have considerations that have to be, I think, thought about seriously as to whether and under what circumstances a president would flush from their bases—whether submarines, bombers or ICBMs—strategic forces in a crisis.

Those sorts of issues seem to me to be right at the heart of the decision that you will be called upon to make as to whether to forego having an ICBM force that is survivable within the first few hours of the crisis, that is survivable without strategic warning.

Two paths are open to this committee and to the Congress for the long-run, and we are talking, I think, here about a decision that will significantly affect American strategic forces and many other issues well into the 21st century.

The first is to follow the plan that the Air Force has recommended. I believe that that resolves, as well as can be resolved realistically, these issues.

This issue of ICBM survivability has bedeviled the political debate, the arms control talks with the Soviets, and many of our other strategic considerations for at least 20 years.

The other possibility is to terminate either the small mobile ICBM or the MX. This body might be more inclined to terminate one of those systems. Your colleagues in the House might be more inclined to terminate the other.

My own judgment is that either decision—the decision to terminate either of those systems—would not be wise and politically could lead to the Congress as a whole, in the interaction with the administration, to end up moving away from maintaining a survivable ICBM force at all.

It also buys us into at least 2 years, if not more, of strong conflict between the two Houses of Congress, between the political parties, and between the executive and legislative branches. I don't believe that conflict in today's circumstances is in our strategic interest.

Thank you, Mr. Chairman.

Senator EXON. Thank you.

Before we go to questions, I would like to give both of you a chance, since you seem to have some difference of opinion, to comment on each other's testimony.

So, Dr. Hicks, in just a moment, I will call on you. If you could keep your remarks to 5 minutes, I would appreciate it. Then we will give Mr. Woolsey a chance to respond.

Just let me say this.

Some of the things that went through my mind when you were both testifying was that I hope you both are not out of touch with reality today. The Townes Commission, the Scowcroft Commission and other studies were from a day of yesteryear. They were before Gramm-Rudman-Hollings.

I don't think there is a single member of this committee who would not like to have, if we could, all of the redundancy in the world to form the deterrence that is necessary.

Unfortunately, the question is not whether we would like to have both—and maybe we will have both before we get through. But the question is how are we going to afford both under the budget constraints and restraints in which we find ourselves today from Gramm-Rudman-Hollings and other pressures and sources.

Having said that, I would just remind you both that money is an object. Some people say that money is no object. Well, money is an object.

Sometimes those of us who sit on this side of the table might not be as well informed as you people who have been in the middle of this, from a technical standpoint.

So, I hope as you answer the questions back and forth it isn't to say that we are for or against, but sometimes choices are forced upon us here by the Congress as a whole, both Democratic and Republican, both House and Senate members, which we might not like, but to which we have to respond.

If you would take 5 minutes now, Dr. Hicks, I would appreciate it.

Dr. HICKS. Thank you, Mr. Chairman.

Actually, you have expressed my feelings very well. I think that all of us can say that there are benefits to having a small ICBM force, and I do not disagree with many of the political and arms control arguments that Jim Woolsey gave today.

I think there is a difference between a clean chess game and the real world. The real world is that when the Soviets have to believe that they can do all those necessary things and that everything will work right to knock out our ICBM land-based force, even unprotected, it requires a lot of heavy thinking, a lot of decisions on their part that they are going to expose themselves to incredible offensive capability by the United States.

So, while I would feel, if I wanted to go my last half a percent, more comfortable with the small ICBM, to me it is a question of priority, and I think you stated that very well.

I think we have needs for many systems. We are not funding, we are not pressing things, many things, that we need in the C^3 area, in the conventional defense area, things that we need very much.

I do not believe, frankly, that the Soviet planner is going to rely upon a "bolt from the blue" to take care of his problem. I just do not believe that.

I think Secretary Ikle is right, that there will be large numbers of warnings to us, recognizing that there is some risk. But I just do not think it is safe for a nation to do the things that they have to do to start that kind of situation in that kind of time that we could not respond with our modern sensor systems.

So, I do not disagree with many of the things that Jim says. In fact, I very often go along with many of the things that he does. But in this case, I think it is a question of priority.

I would have been, frankly, very happy, as I said a year ago, to see the Congress recognize that one of our important things here is our offensive capability and to be willing to cheaply buy MXs. You know, we start out wanting 200 or so of those, and as a result of the Scowcroft Commission, we are down to 100. By the time we got through the rest of the gamuts, we were down 50 or 40. But those are cheap ways of getting you into a situation where you have a great deterrence.

Nobody wants to use any of these things.

Now, we also have an interesting thing that I would think Jim would wonder about. But I really know the answer because he believes in offensive capability, too, and he recognizes that he can get some cheaply by having more MXs, and that is, if you really believe that you are going to soak up all of the SS-18 force with your small ICBMs, why bother even with the rail mobile. The answer, of course, is that we need to have as much offensive capability for deterrence as we can to offset their enormous capability.

I, frankly, feel that we can sit down with people who understand the situation and who fought wars and ask them where would you rather spend your money, what kind of war are we going to fight. I think that we have to be prepared to fight wars that we don't have the capability to fight well today, and that that transcends the issue of spending the $50 billion on the small ICBM.

Senator EXON. Thank you.

Mr. Woolsey.

Mr. WOOLSEY. Mr. Chairman, I take very much to heart your admonition to make sure that one is not out of touch with reality. I think anyone who thinks about and works on these systems feels out of touch with reality a very high proportion of the time.

I think that it is important also—I completely agree—to concentrate on priorities and on cost. I understand very well the Congress' and this committee's—in particular this committee's—obligations in that regard, and I am sympathetic to them.

I would just say that in assessing priorities, my first one has been for some time and is still the survivability of our command, control, and communications.

I believe that it is important to maintain a sea-based ballistic missile force and to modernize it. But, right behind that, as far as I am concerned, would be preserving a survivable—and by that I mean survivable across a full range of scenarios—ICBM force.

I must say that I think that the most important thing in these areas is often the trend and direction, more so than the precise pace or initial operating capability date, or the exact size of the force structure.

It seems to me the most important thing with respect to our ICBM force is to let the Soviets know in no unmistakable terms

that we are moving toward survivability with that force regardless of anything they can do; that we do not need them; that we do not need an arms control agreement; that we do not need anything else in order to preserve that survivability.

That determination on our part I believe makes it considerably less likely that they would put the sort of effort into anti-submarine warfare or the other steps they would need in order to be able successfully to put at risk our whole range of strategic forces.

I agree with what Don said that a Soviet commander would have to believe a very great deal in order to urge an attack on U.S. strategic forces.

I do not believe that normally here we are talking about the likelihood that we will wake up some fine March morning in the midst of "glaznost" and arms control negotiations and all the rest of it and find our ICBM fields vaporized.

I think what we are talking about is long-run trends with respect to national will, and long-run trends with respect to convincing the Soviets that they cannot isolate one portion of U.S. strategic forces, such as the submarines, and then concentrate on that.

I think I will close with that, Mr. Chairman.

Senator EXON. I appreciate both your statements.

I am going to forego my first round of questions and come back later because I think there are some people who cannot remain at this hearing for very long. I will be here all afternoon.

So, to try to speed things up, I will start out by recognizing Senator Thurmond for questions.

We will proceed on the 6-minute rule.

Senator THURMOND. Thank you very much, Mr. Chairman.

RAIL-GARRISON BASING MODE

Dr. Hicks, did you consider the rail-garrison basing mode during your tenure in the Department of Defense, and what are the advantages and disadvantages of this basing mode in your view?

Dr. HICKS. Senator, it has to have strategic warning to be survivable in the case of a "bolt out of the blue" attack.

If you really believe that a "bolt out of the blue" attack will exist and you are not going to get any strategic warning—and, of course, that is what it says when you talk about "bolt out of the blue"—then the garrisoned MX is a vulnerable issue, just as the MX would be if it were in Minuteman silos.

The fact is that I do not believe that is the way the world is going to be. We are going to have strategic warning. When we do have strategic warning, we will have ample time to get the garrisoned rail-mobile system out in a great many areas and make it a very, very hard target, indeed.

So, as a function of where I think we can go, it seems to me to be a nice compromise, and I felt that way before I left the department.

I don't believe in the "bolt out of the blue" phenomenon. I think we are always going to have strategic warnings and alert systems.

It is not as expensive as it would be if you went to a full mobile, all-up situation, which I think is not required.

As I said, sir, before you came in, an additional step on the way to the small ICBM, which we have discarded for political and other

reasons—well, really, not many other reasons except political as far as I am concerned—is the whole issue of the Carryhard system, which will, in fact, give you as much survivability as a small ICBM for one-half to two-thirds the total cost.

Senator THURMOND. Thank you very much.

Senator EXON. Let me interrupt for just a moment, without charging it to your time.

We are going to be dancing around some highly classified issues this afternoon, I can sense that already. Let me say that this statement has been cleared by the Air Force: based on the strategic warning indicators that SAC tracks today, they have extremely high confidence in the quality, credibility and timeliness of the DOD indications and warning system.

Now, without going any further than that, I think I can say without fear of contradiction from anyone, that the "boit out of the blue" theory that we were forced to consider for a long, long time is not nearly as vital as it once was.

Thank you, Senator, and back to you.

Senator THURMOND. Thank you.

Mr. Woolsey, in your judgment, does the rail-garrison basing mode provide sufficient survivability in periods of crisis to constitute a stable contribution to deterrence?

Mr. WOOLSEY. Senator Thurmond, I believe it certainly does once it has been flushed from its garrisons for several hours.

I believe it would if—before it is flushed from its garrisons onto the rail system—the circumstances of the crisis were those in which the President could realistically take that action or other actions, such as putting submarines at port to sea or moving, say, bombers to airborne alert. But some crises are not of that nature. Some crises are ones in which presidents are reluctant to take steps of that sort because they fear they might make the crisis worse.

Nations, over history, have often thought they were going to have strategic warning of wars or major troop movements by the other side and then found out they did not have it.

I have no quarrel with SAC's technical assessment in March of 1987 of its judgment, assuming that the Soviets continue to do business the way they are doing business now, that we would have the degree of strategic warning that they assess, that SAC would have that degree of strategic warning.

But there is a big, big difference between saying that and predicting with confidence that in a crisis, such as the Cuban missile crisis, or in a crisis, such as that which existed in the Yom Kippur War in 1973, we are confident that the President would take the steps necessary to make these forces survivable.

It is just too difficult to predict the future I think to be able to say that.

SMALL ICBM

Senator THURMOND. Mr. Woolsey, do you have any concerns about the independence of the small ICBM from the need for strategic warning when deployment is limited to the Minuteman launch sites?

Mr. WOOLSEY. I would say I have some concern if it were limited to the Minuteman fields, Senator Thurmond. I would prefer a small mobile system that was based in the Southwest, because it is easier for the system in its day-to-day status there, and particularly within the time of tactical warning.

It is easier for the system to charge the Soviets a very high price to attack it.

I believe that the cost savings from basing in the Minuteman fields in annual operating costs are the principal reason why the Defense Department and the Air Force is interested in basing the systems in the Minuteman fields.

I believe it would be a reasonable compromise to put some of the early missiles in the Minuteman fields and to open, let's say, one Southwestern base with the more survivable deployment mode.

I think a mode of basing on the Southwestern bases gives you a greater degree of survivability against such threats as close-in Soviet submarines, particularly if those should be equipped with depressed-trajectory SLBMs.

We would probably know if the Soviets were testing systems of that sort. We would probably have some time to reorient a small mobile deployment away from the Minuteman fields and toward a Southwestern basing. But I would feel more comfortable with the systems as a whole if we had at least one foot in the Southwest from the beginning.

Senator THURMOND. I believe my time is up, Mr. Chairman. Thank you very much.

Senator EXON. Thank you, Senator.

Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman, and my welcome to both our witnesses.

I have trouble with the scenarios that both of you draw in terms of what reality is. I see it as no more likely that the Soviets would drop 2,000 warheads on 1,000 Minuteman silos than I can conceive of a "bolt out of the blue" or an attack on strategic warning. I find that to be a totally incomprehensible scenario because it would mean instant obliteration of the Soviet Union.

So I cannot buy your window of vulnerability. I am not sure that the Scowcroft Commission didn't close it entirely, but, apparently, there is still a draft.

ICBM VULNERABILITY

So, we are facing what you call the ICBM vulnerability issue. I think it is a theoretical vulnerability only, but we have to deal with it because some folks feel that it is there and it is going to have to be dealt with, either by removing the perception of it, or, I guess, by putting hundreds of billions of dollars into some mobile land-based system.

Mr. Woolsey, first, if I could ask you this question, if you saw this vulnerability—which you do—and you want to deal with it, why doesn't the Midgetman system deal with it?

I heard your explanation and I understand the political deal that you suggest is possible and the compromise which will avoid a fight between the House and the Senate. I followed all of that.

But I do not understand militarily why the Midgetman does not deal with that perception that you have and the reality which you see of there being an ICBM vulnerability.

Mr. WOOLSEY. Do you mean the assumption being that one might proceed with Midgetman and the hard-mobile launcher, but not with MX? Is that the assumption?

Senator LEVIN. Yes.

Why doesn't that address your problem?

MR. WOOLSEY. Well, the small mobile ICBM, unlike MX in rail garrison, does address the problem I was focusing on, the hedge against Soviet anit-submarine warfare capability.

I prefer going forward with both. If I were forced to decide which I thought were more important, I would have to say the small mobile.

But I do believe both are useful and important parts of U.S. strategic forces, and I would prefer to see us go forward with both. I care much less about the pace with which we go forward than about the direction, Senator Levin.

I think the general shift toward mobility for our ICBMs over the long run is one which presents the Soviets with a near-insoluble problem with respect to targeting our strategic forces as a whole.

Now, I realize that we are talking about highly hypothetical circumstances here. But we are also talking about some 30 years into the future. And the ability to predict, let's say, in 1949, when NATO was founded, the strategic crises of the next 30 years, up until 1979, would not have been great.

It is no greater in 1987 for the 30 years that will take us out into the 21st century.

I do not believe the Scowcroft Commission said that there is no problem or window of vulnerability with respect to the ICBM force. I think what we said is that the urgency of doing something about that and the plan of doing it with one ICBM in one basing mode had been mistaken notions.

We had time to fix it, but it was important to fix it. I still think that. I think we do have time to do this, and it is more important to do it right than it is to do it fast.

Senator LEVIN. So, you are not necessarily supporting the pace in this budget?

Mr. WOOLSEY. Well, I believe that a decision to enter full-scale engineering development with a small mobile ICBM in 1987 is the right one. I think the commitment is important because once you commit to the full-scale engineering and development of a system, 9 times out of 10 or perhaps more frequently than that, the system goes on to deployment. It really is the crucial decision in the life of those weapons systems.

I care much less about the 1992 IOC, frankly.

Senator LEVIN. You said less?

Mr. WOOLSEY. I care less about the IOC than I do about the fact of the country committing to go mobile with its ICBM force.

Senator LEVIN. With Midgetman?

Mr. WOOLSEY. Yes, with both; but with Midgetman preeminently, I would say.

RAIL-GARRISON BASING MODE

Senator LEVIN. Please go back to your first answer because I don't see how you addressed it. Why do we need to build a rail-garrison MX if we are going with Midgetman? I understand that you prefer it. I know your conclusion and I understand the politics of it because you came up with that during your statement.

But try it militarily again. If we are going with Midgetman to address that perceived vulnerability that you see—and, again, I do not share that perception, but I am willing to assume it for the sake of the discussion—try again why we shouldn't just go with Midgetman. It is preferable in your book, so why not just go with it?

Mr. WOOLSEY. We have already established a production line for MX. We are going to need to keep that line going in order to produce the test missiles. The country and the Congress, I believe, are at least committed to 50. And, with respect to the number of MXs that are built, I would prefer 100. But if whatever number of MXs are procured, whether it is 50 or 100, for the Active Forces, it seems to me that ultimately one is going to want to move them into a more survivable mode than they are in the Minuteman silos.

I thought when we worked on the Scowcroft Commission report 4 years ago, and I think now, that for some period of time, the silo basing of the MX is an acceptable solution. But over the long run, I believe that deploying them in a rail-garrison mode is comparatively inexpensive, compared to many of the other basing modes, and is a reasonable way to go.

I am less insistent or less concerned about the pace of that decision, I believe, than I am about the decision to move toward the small mobile ICBM.

Senator LEVIN. My time is up.

Thank you, Mr. Chairman.

Senator EXON. Senator Cohen.

Senator COHEN. Thank you, Mr. Chairman.

MX IN EXISTING SILOS

Mr. Hicks, if we just concentrate on the most effective approach, I assume that it would be let's just build MXs and put them in existing silos and not worry about hardening or anything else. If you are not seriously concerned about a "bolt out of the blue," why bother even trying to make MX mobile in any circumstance?

Dr. HICKS. Well, there are certainly some arguments in that direction. If I understood what Senator Levin said, that would be an approach that I think you would be willing to take, if everybody believed as he believes that there really is not that kind of "bolt out of the blue" threat.

I feel that way myself.

Senator COHEN. So you would agree with Senator Levin on those premises? You don't believe in the practicality, except for a remote possibility, that the Soviets would contemplate a "bolt out of the blue," and just stick the MXs in existing silos and adopt, if you have to, a "prompt launch response?"

Dr. HICKS. Well, if you remember, we had some numbers which we discussed a year ago, of $2 billion or $3 billion for those second 50 MXs, and that is a very appropriate thing to do.

Now, the thing that I think Jim left out in his answer to you, Senator Levin—if I may continue in that one particular mode——

Senator COHEN. If you do it on his time.

Dr. HICKS [continuing]. Is that we do have to have a number of offensive warheads, I believe, in order to account for the high-quality targets that we have in the Soviet Union in order to have a good deterrence.

So, numbers of warheads are important.

If you go with the number of warheads we are talking about, which will be the small ICBM, you are not talking about a $40 billion or $50 billion program, you are talking about an $80 billion, $90 billion or $100 billion program.

Senator COHEN. Excuse me, but are you using life-cycle costs?

Dr. HICKS. I am using life-cycle costs.

Senator, I recently have not been given a briefing on the costs. But as I remember the numbers, they are like that—$40 billion to $50 billion life-cycle costs for the small ICBM, 20 years, and they double that or more for the 100.

The reason that I supported, as I said in my statement, the garrisoned rail-mobile system is that I realize that some people are concerned about the "bolt out of the blue."

I believe that there can never be a real "bolt out of the blue," but there could be things that we would find happening more rapidly than we would like to be able to handle; that is, we would not want to have to respond to tactical warning. And, therefore, the garrisoned rail mobile gives us that approach.

Senator COHEN. May I perhaps explore that with you, Mr. Woolsey, in terms of the Air Forces's reasoning? I don't think I am mixing my metaphors to suggest that they are engaged in circular reasoning as opposed to the circular dispersion of the MX.

On the one hand, they talk about the need for a railroad garrison concept because a continuous dispersal on the public rail system would not be tolerated. There would be public interface and we would have great difficulties, is I think the way someone phrased it.

On the other hand, they recognize that if they do not get this sort of strategic warning, they have a real problem of survivability. So they suggest, almost with equal fluidity, at that point, that that is easily overcome by simply going to a continuous rail deployment despite public interface.

So, on the one hand they are saying that we don't want to deal with a public interface problem, so we are going to have a rail garrison; and to the extent that we want to avoid the survivability problem, just go with public interface.

How do you reconcile those two?

Mr. WOOLSEY. Well, I think one has to make the assumption that the public mood would shift rather radically in the event of a crisis; that the public would be very worried about having MXs out on the rails in normal peacetime, but that if there were a strategic crisis, the public would accept it and accept it quickly.

The problem is I think the world is somewhat messier than that, and the transition between peace and crisis or crisis and serious crisis is a somewhat muddy thing that we do not perceive often until after the fact.

Senator COHEN. Well, let's talk about the circumstances under which you would have, for example, this sort of public interface.

What sort of warning, No. 1, would be necessary?

No. 2, the Air Force also has suggested that it could be dispersed even under ambiguous circumstances. What would be the public reaction—not only the public reaction, but what would be the Soviet reaction—if suddenly we rolled out the MX missiles under ambiguous circumstances? Could that create greater instability rather than more security?

Mr. WOOLSEY. In support of the rail-garrison system, Senator Cohen, I would have to say that one interesting feature of it, as I understand it, perhaps unlike the bombers or the submarines in port, is that, at least for some period of time, one might be able to flush it, at least under current circumstances, without it being known at least that all of it had been flushed from its igloos. If it is under cover and it moves into rail yards or tunnels or whatever, I suppose that, unless one credits the Soviets with extremely capable intelligence, there could be some uncertainty in the Soviets' minds about whether the system had actually been flushed from its bases.

And, of course, there can be degrees.

Senator COHEN. You don't think they would intensify their intelligence collection at a time when we see signs of strategic warning?

Mr. WOOLSEY. I'm sure they would. It depends on how effective they can be, and one gets into a world of agents by railroad tracks and real-time reconnaissance from space, and it is a very difficult sort of thing to be precise about without looking at specific studies and specific circumstances.

ARMS CONTROL VERIFIABILITY

Senator COHEN. In an arms control context, are there any kind of verifiability questions that you would have if you had adopted such an approach that you could, in fact, disperse the MX under circumstances in which the Soviets could not detect it?

Mr. WOOLSEY. I am less concerned about verifiability of precise numbers, Senator Cohen, if the United States has moved toward mobility for its ICBM forces. Then I am much less concerned than I would be if we were in silos or in fixed locations, such as under a multiple protective shelter system.

Senator COHEN. If you are unconcerned about numbers, should we be unconcerned about Soviet numbers of rail mobiles?

Mr. WOOLSEY. Well, let me phrase this a little bit more completely.

I believe the political aspects of verification are still very important. It is important whether or not the Soviets keep agreements.

But the military vulnerability of a mobile ICBM force is considerably more insensitive to numbers of warheads on the other side than the military vulnerability of a silo-based or a shelter-based force. This is what I meant to say.

Now, if the United States is moving, and moving decisively, toward this Air Force combination, the small mobile and rail mobile, for its ICBM force, then as it becomes apparent to the Soviets that we are going in that direction, I believe that, unless they are very, very unwise and wasteful, they will see that simply multiplying numbers of weapons on their side is an extremely inefficient and low leveraged way to try to put the U.S. forces at risk.

The thing they ought to do is to move into extremely sophisticated intelligence capabilities and try to target mobile systems one on one, not just add warheads in order to try to barrage huge areas of the United States.

Senator COHEN. Has that been their pattern in the past?

Mr. WOOLSEY. It has not been their pattern in the past and it is one reason I like the mobile system, because it executes an end-run around what the Soviets have found it easy, under their system, to do.

They have found it relatively easy by obtaining Western technology and working on accuracy with their best engineers and improving their yields and so forth to build large numbers of accurate, MIRVed, ICBM warheads. They have not found it so easy to do the sorts of things we can do with intelligence systems, electronics, optics, and all the rest, and that is a very, very hard job.

Senator COHEN. You would rather force them to become more acute in their targeting and analysis, then?

Mr. WOOLSEY. I would like for us to step outside the chain of what they have found it easy to do.

Senator EXON. Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

Gentlemen, welcome.

Let me ask first, Mr. Woolsey, this question.

SMALL ICBM

This morning, in a presentation by General May and Dr. Woodruff, essentially the real justification for the very great expense that is associated with the small missile was said to be in providing a response to a "bolt out of the blue" attack.

When I then asked General May what his opinion was of the probability, the reality, of a "bolt out of the blue" attack, he responded that it would leave the Soviet war planner so vulnerable, that the cost would be so high, he thought it really an irrational decision. And being irrational, he thought it improbable.

Do you agree with that?

Mr. WOOLSEY. On March 7, 1987, I do very much, Senator Wilson. But I do not think that is the central problem that one is trying to deal with with a small mobile ICBM deployment.

I think that what we need to try to do is to move toward an ICBM system that would be survivable, even against an attack without strategic warning. This is, as I mentioned briefly in my opening remarks, essentially to hedge against the day which I believe is surely coming, in which the Soviets will have MIRVed and accurate SLBMs and accurate cruise missiles, a submarine force large enough to be deployed relatively close to American shores, and could put at risk our command, control and communications,

our bomber bases, and such systems as rail-garrisoned MXs or silo-based MXs or Minuteman, with systems that have a relatively short time of flight.

Now, under those circumstances, it seems to me there is a large pay-off for Soviet R&D in focusing on putting at risk our ballistic missile submarines as well.

I do not think they can do that easily. As I said earlier, I think submarines, even very large ones, are likely to be quite survivable for the foreseeable future, as long as they are in the open ocean, as long as they can run silent and run deep, and as long as there is good communication with them.

But we would in that world of the 1990s and the early 21st century, which I described, be in a world in which our whole survivable strategic force was essentially based in about 12 relatively large boats at sea, each about the size of a World War II cruiser.

Senator WILSON. Let me interrupt you here, I'm sorry, but we do have time constraints on us.

It seems to me, by the way, that the foreseeable future is an interesting timeframe and, also, that you have made by your answer a rather compelling argument for SDI. But let me ask this question.

Let's assume that at some point in the future, for the reasons that you have described, that "bolt out of the blue" becomes a more plausible possibility, would not a better means of defending just the missile capability, our retaliatory deterrent, be found in the use of Carryhard? I would ask that question of both of you.

Dr. Hicks, you might want to respond first.

Mr. WOOLSEY. At the time we looked, a year ago, at the Carryhard in the Deutch Committee, the committee felt that the effectiveness for a reasonable cost of the small mobile ICBM in terms of survivability was better than that of Carryhard. The curves essentially crossed over about the time Soviet accuracy achieved around 300 feet in CEP.

Now, Dr. Hicks testified a short time ago that he believes within the last year the cost of the Carryhard system has declined.

I have not reviewed the system in the last year. If that is true, that would have the effect of shifting those cost curves in such a way that the small mobile might become more cost effective, or would become more cost effective, only when Soviet accuracy got to a lower figure than 300 feet CEP.

I don't know what the precise number is.

I believe that Carryhard was a serious contender. We gave it serious consideration. I know Dr. Hicks was particularly interested in pursuing it.

I believe it is worth studying. I agree with him that the issue should be studied. I am never opposed to studying anything.

But it does seem to me that, over the long run, the possiblity of the Soviets moving toward terminal guidance with their own reentry vehicles makes deployments at fixed points on land a general direction that it is less desirable to go in than the direction of mobility, because that leaves us in the path of what has historically been their most effective tactic in putting our forces at risk—namely, increasing the yield and reducing the accuracy, reducing the CEPs and generally improving the ability to attack fixed

points. Essentially, I think, by Carryhard we are playing into their long suit, and that is admittedly a qualitative judgment on my part, but it is one that I believe.

Senator WILSON. Mr. Chairman, I wonder if we might get Dr. Hicks' response to that question as well.

I was not here earlier if he then addressed it.

Senator EXON. Go ahead.

Dr. HICKS. I was quite certain, Senator, when we began to get the original Air Force numbers on the cost of these decoy silos, that they were incorrect. That is why, initially, I pressed to have that included as a study.

The numbers that were given to the Deutch panel were the original Air Force numbers, without a lot of investigation. They were rough estimates.

As the year proceeded and people began to approach that problem more specifically, the cost of those systems dropped dramatically to something approaching the costs I had been getting from contractors early in the game.

You can go down to 200 foot CEP and still find that the cost of the Carryhard is on the order of a half of the small ICBM force.

So, I am not trying at this point to say that we should do it. I have talked enough to people who say it would be a politically bad problem in trying to preserve MX despite its real capabilities. But I think it is a mistake for us not to continue to pursue that situation.

If I might add one thing, I would comment on one thing that Jim Woolsey said.

If you look at the new systems that he talks about, the increasing accuracy, the cruise missiles, the large numbers of submarines and so on that make the risk of our ICBM force even worse, you find that those same technical capabilities will put the small ICBM at risk. Even in the Defense Science Board study, air breathing vehicles, manned and unmanned, might find the small ICBMs and make them vulnerable. I believe that to be the case.

In fact, I think there is a significant less chance from a technical standpoint of the Soviets ever being able to find our ballistic-missile submarines compared to being able to find and destroy the small ICBMs. I think both are very difficult tasks. But, when we talk about the problems of them doing things that we are worried about, I am much less worried about the submarine survivability than I would be about the small ICBM survivability in the decades ahead.

Senator WILSON. Thank you, gentlemen.

Thank you, Mr. Chairman.

Senator EXON. Senator Humphrey.

Senator HUMPHREY. I am just going to listen for a while. I just came in. Thank you.

Senator EXON. All right.

We will go to Senator Gore.

Senator GORE. Thank you very much, Mr. Chairman.

THREAT AGAINST MOBILE MIDGETMAN

I think on the last point just made, the Deutch Commission—and Mr. Woolsey can correct me if I am wrong—I think the Deutch

Commission did look at the possibilities for terminal guidance and real-time surveillance being used as the threat against mobile Midgetman and concluded that it was highly unlikely. And, while it is true that it is unlikely that the Soviets will in the near future find a way to target our submarines, it is also true that the two environments are very, very different. And, as Mr. Woolsey said, we essentially are going to a situation at sea where we have 12—only 12—very large, relatively slow, platforms, and, while we currently have a hard time imagining how the Soviets might do it, and while I personally think it is unlikely they are going to do it, you know, they are building attack submarines so prolifically, there are scientific breakthroughs that we need to hedge against.

But that is not the main purpose for which I want to use my time.

I want to focus in on this business of strategic warning and why it retains some importance.

Mr. Woolsey, you talked about potential crises that could develop, and you used the Cuban missile crisis as an example.

This business about the "bolt out of the blue" is itself somewhat unrealistic, because if we have a genuine, God-fearing crisis, where tensions are mounting, in a time when, unlike the Cuban missile crisis, there is strategic parity between the superpowers, I can readily envision circumstances where the President of the United States goes to the opera when he doesn't even like the opera, in order to keep people calm, and in order to give a message to the Soviets and to the American people that we are not going to allow a psychology of fear and crisis to itself contribute to the danger faced by the world.

If, under those circumstances, the President of the United States says "roll them out of the sheds, boys, put them out on the rail network and get those security cars out there and just take them from Little Rock toward Memphis," and the Soviets see that going on and the news media covers that, that move, in and of itself, elevates the fear, makes the crisis more palpable. If that is the kind of scenario that we want to leave ourselves with, I personally think it is a mistake.

Now, on this question of whether an attack under those kinds of circumstances is plausible or not, I personally agree with my colleague, the Senator from Michigan, that all of the scenarios that are discussed with nuclear war are all irrational. It is crazy.

But that has not kept the possibility from driving our political system forward. The window of vulnerability argument has been based on propositions that you, Secretary Hicks, reject out of hand today.

SALT II TREATY

The SALT II Treaty was killed on the basis of assertions that some of those who attacked it just reject out of hand today—the "bolt out of the blue," or a Soviet first strike under similar circumstances. Those are just completely crazy.

And, the irony of ironies is that those who support an SDI program configured primarily for the purpose of complicating a Soviet attack against our ICBM forces, are implicitly saying that an

attack on our ICBM forces is of sufficient plausibility to warrant an expense of many orders of magnitude larger than the Midgetman program. They are saying "Oh, we have to do this to complicate a Soviet first strike." And then, when the notion of a Soviet first-strike is talked about in this context, well, then, all of a sudden, it is just not realistic.

The fact is that it has political and geopolitical significance.

Some, incidentally, have been consistent on this point. The Committee on the Present Danger, for example, strongly supports mobile Midgetman for precisely the same reasons that it opposed the SALT II Treaty. Others are not so consistent.

For myself, I believe, with my colleague from Michigan, that the plausibility level of a Soviet first strike is low under any circumstances. But I believe very strongly that the political and psychological significance is so great that we are never going to have stability in the arms race until we diminish and, if possible, eliminate the fear of a first strike on both sides.

If, after all these years of debate, we are presented with a system, in the form of Midgetman, which makes it technically impossible for the Soviet Union, with its entire arsenal of warheads, to knock out a survivable, prompt, hard target-capable, accurate silo-buster that can be used in response, you would think that those who have been making these arguments all these years would say, "Finally, we've got the solution."

I say, again, even though the first-strike scenarios are admittedly implausible, that the political significance is such that we ought to try to encourage stability in the arms race by achieving survivability with this system.

Now, Mr. Woolsey, you used a scenario right at the beginning of your presentation about SLBMs with depressed trajectories striking suddenly at submarine ports and air bases. Is that correct?

Mr. WOOLSEY. Yes, Senator Gore. The thrust of the discussion is esentially the same as the discussion in the Scowcroft Commission report on that same issue.

Senator GORE. Well, my time is up, and I will just conclude by saying this briefly.

The Department of the Air Force's explanation of the rail-garrison program—for which I support the R&D, or I think I will—they point out that the garrisons are going to be located on those same Air Force bases that are already targeted under the scenario that Mr. Woolsey pointed out.

Thank you, Mr. Chairman.

Senator EXON. Thank you.

I have just a question or two. I passed during the first round.

Let me ask both of you this question.

Aside from all of the other arguments pro and con on the Midgetman, what is your view—would not mobile ICBMs give the Soviets an advantage, with their large land mass and area, over the United States?

Second, what do you each think about the difficulties, or is there significant difficulty, with regard to Midgetman, either in the United States or the Soviet Union, on verification matters?

It would be pretty hard to have on-site inspection, I guess, of 5,000 pickups running around all over the country with a Midgetman type missile in the back end.

Would you answer those two questions.

Mr. WOOLSEY. Yes, let me try both of those, Mr. Chairman.

First of all, I think the Soviets are likely to shift toward mobility, as they already are, with both rail-mobile SS–X–24s and the SS–25, pretty much regardless of what we do. I don't think they are going to forego that, and I believe their motivation has been provided principally by the hard target kill capability that is coming on-line in the U.S. strategic forces, the MX, the Trident II, and, to some extent, and much less so, the more modern versions of Minuteman III.

I believe that if we did not move toward survivability for our own ICBM force, we would face a world in the 1990s and the early 21st century in which the Soviet ICBM force was highly survivable and ours was not.

That, I think, would be the worst of all possible worlds.

Personally, I would prefer a world in which our ICBM force, indeed our whole strategic forces, were survivable and the Soviets' were not. But I do not believe I am going to be able to get that.

Consequently, if I have to pick an intermediate case, I would rather have one in which both sides' forces were survivable than one in which both sides' forces were vulnerable.

I believe the survivability, even if we have to grant it to the Soviets, is particularly important for ourselves.

So, if they have an advantage, as both sides move toward mobile ICBMs—and they do to some extent with respect to their large land area and the fact that they don't have to file environmental impact statements and so on—if they have an advantage, it is an advantage in the deployment area within which to make their forces survivable. That worries me less than if the advantage on their side were one that could put our forces at risk.

Now, the reason I do not believe that the Soviets would be inclined to deploy such a great number of mobile ICBMs that they could effectively barrage our mobile ICBM force is both because such a large amount of throw-weight is required to barrage a mobile ICBM force of the sort that we are planning, and, also, because the cost to the Soviets of building a large number of mobile systems, even with their administered prices and all the rest, is very great.

We all know, and it is one reason that you are sitting around this table, that it is considerably more expensive to deploy an equal amount of throw-weight in a mobile force than in a fixed force, and that pressure I think to some extent acts on the Soviets as well.

It is for a similar reason that I am less concerned about verifying precise numbers of mobile Soviet ICBMs, as long as the U.S. ICBM force is mobile.

If you have the Southwestern basing—and I think this is an important number—on the four Southwestern military reservations, then small mobile ICBMs based in those locations and flushed to both on and off the base within the flight time of Soviet ICBMs charge a price of attack roughly equivalent to the entire throw-weight of all Soviet ballistic missiles, ICBMs and SLBMs. That is a great deal of resilience against a barrage attack. The Soviets, I suppose, could significantly add to their throw-weight in principle by adding lots of mobile ICBMs, SS–25s deployed in the tundra. But if they do that, they are going to have very little money, effort, or resources left to do some other things that I think would be much more troubling to us.

Dr. HICKS. I cannot disagree with what Jim says. We are talking here again about costs of the situation, I mean, what priorities exist, and what we have in our inventory which I believe, for as long as I can foresee, will be a survivable capability.

And so, we can certainly match the Soviets, I suppose, in these areas. We certainly do not match them in the conventional area, as we all know. We seem to be unwilling to do that.

My feeling is that we are safe from the "bolt out of the blue." If there is a "bolt out of the blue", we are safe anyway because we have an enormous capability in that 30 to 40 percent of our bombers are out and ready to go, and that one-half to two-thirds of our nuclear submarine force which is out, ready to go, and whose survivability is improving all the time.

I do not have, as I said earlier, the same kind of concern about the Soviets finding our submarines, even if they are large and there are only 12 of them, than I do having air-breathing vehicle capability to ferret out and conventionally destroy, for example, our small ICBM force.

An interesting point to ask yourself is what would we do if our ICBM force came under only conventional attack. Would we launch?

Senator EXON. My time is up, but I am going to take a few more minutes as we start the second round, to which I am entitled.

Let me ask this question.

D–5 MISSILE

Compared with the MX, and I suspect the D–5 would be about the same, it is three or four times more expensive to deliver one warhead through the Midgetman than it would be through the heavier system with the heavier throw-weight.

If we are going to have a counterforce capability in the D–5 missile, which we all know we are going to have, and if submarines are survivable for the foreseeable future—and I think we all agree that they are—why wouldn't a plan that buys the MX rail garrison and then adds a few more Tridents for a survivable counterforce make more strategic sense and at a considerable saving in cost than the combination of a rail garrison with the small ICBM?

Dr. HICKS. I think it would.

As a matter of fact, Senator Gore brings up an interesting point, the issue of what would happen if we found that the President was

taking those rail mobiles out of garrison, what impact would that have on Soviet thinking.

You see, I have a totally different answer than he does, because, to me, what that would do would be to suppress the problem, not to increase the problem the way he sees it.

I would view this, and I think the Soviets would view it, since we have the same striking power, whether they are in garrison or not, that we are preparing, if we must, to soak up their attack. That has to be something that tells them that a first strike is not really warranted.

So, I cannot see that having the President take these things out of garrison and move them into a more secure situation is anything but beneficial in preventing a crisis.

Senator EXON. Thank you.

Mr. Woolsey?

Mr. WOOLSEY. I would just say, Mr. Chairman, that I think one always needs to do those calculations about cost per deliverable warhead in terms of cost per surviving deliverable warhead. I don't know whether the three or four times figure pertains to per warhead or per surviving warhead.

In the case of Trident, if you are talking about alert forces at sea, all of those forces at sea might well be expected, I think for some time, to be surviving ones.

If you are talking about some land-based deployments, sometimes you have to deduct a certain number from the non-Midgetman systems in order to take account of what might be successfully attacked on the first strike.

SMALL MOBILE PROGRAM

I believe that the plan you set out is one that deserves full and fair consideration. But the reason I would suggest proceeding at whatever pace the committee determines into the small mobile program is principally because of this issue that I raised earlier, which is the need, over the long run, to have an ICBM force to hedge against Soviet improvements in antisubmarine warfare.

It is a difficult subject to discuss in open session. I guess I would just say that I believe that since the retirement of Admiral Gorshkov, if anything, the Soviet commitment to its submarine force is even greater, if that was possible, than it has been in the past.

The combination of Soviet effort in quieting, security compromises, the Walkers, and so on, and the fact that the United States Navy has been spending and focusing much of its effort in recent years on other capabilities, to me means that we have some work to do to improve our own ASW and to keep up with in some areas some of the ASW work that the Soviets are doing.

That was not true a decade or two ago. But they are very, very vigorous and committed in the antisubmarine warfare field.

I share the ultimate judgment that you expressed and that Dr. Hicks echoes and that I stated in my first remarks about the survivability of submarines at sea. But that, as other things, in war and in military competition, is something that we deserve to be at least a little bit agnostic about.

Senator EXON. Thank you.

Senator Thurmond.

Senator THURMOND. Thank you very much.

Mr. Woolsey, I have about three questions here. If you make your answers very brief, we can move on.

RAIL MOBILE/RAIL GARRISON BASING

Did the various panels on which you have served, including the Scowcroft Commission, consider rail-mobile or rail-garrison basing for Peacekeeper missiles? If so, why was that mode not recommended?

Mr. WOOLSEY. We considered rail mobile briefly in the first Townes Committee, and to my mind, nothing more than a pro forma consideration since then. We did not consider rail garrison at all. Rail garrison is a new idea. It had not really been dealt with.

But the reason rail mobile, to the best of my memory, was rejected in the first Townes Committee was because we were still at that point focusing on a single system with a single missile and a single basing mode to solve all of the problems of the ICBM force.

We did not believe, and I do not believe now, that a rail-based system can do that.

The first time I believe rail garrison became seriously considered in the last year or so was because it has been looked at together with the small mobile ICBM and I think it complements it nicely.

Senator THURMOND. Mr. Woolsey, what actions would you expect the commander of the Strategic Air Command to take if the United States was in a period of deep crisis and small ICBMs were sitting exposed next to Minuteman launchers?

Mr. WOOLSEY. I would expect him to recommend to the President that those missiles be moved outside the fences within the Minuteman fields and be deployed into the rest of the areas.

Those areas up there, Senator, although relatively empty, most of them, are farm and ranch land. My family and I camped out two summers ago in Wyoming, in between two Minuteman silos, on a dude ranch. There are people there.

It is not something that one does lightly.

I would expect a SAC commander to recommend that the missiles be moved outside the fences. I am not certain—and I think it would depend on the person of the President and the nature of the crisis—I am not certain that the first recommendation of that sort would always be followed by the President.

Senator THURMOND. Mr. Woolsey, doesn't this matter really boil down to about three choices. One is to pursue the MX missile, known as Peacekeeper, which carries about 10 warheads, or go forward with a single missile, the Midgetman, or delay both and try to go forward with both?

Doesn't it boil down to about those three choices?

Mr. WOOLSEY. It does, indeed, Senator Thurmond.

Senator THURMOND. Of course, if they went forward with the Peacekeeper, they could consider the submarines that were mentioned here a few moments ago.

Now, of those three, which would you choose?

Dr. Hicks, which would you choose?

Mr. WOOLSEY. I would prefer moving forward with both, Senator Thurmond.

Senator THURMOND. You would favor both, even though it would delay both programs for several years?

Mr. WOOLSEY. If the commitment were made to go into full-scale engineering development with the small mobile ICBM, I would prefer to see the pace of both programs slowed, than to see either one canceled.

Senator THURMOND. Dr. Hicks?

Dr. HICKS. Senator, because of the cost issue, and, ultimately, when you start the program, it is going to end up costing money, and sometimes the pace is slow and the cost is higher—I don't support the small ICBM in any case.

I believe that we could look at the garrisoned rail mobile as a good compromise. I might prefer, if I want to meet all of the conditions that I am not personally worried about but that many people seem to be—that is, a "bolt out of the blue"—to proceed to Peacekeeper and the Carryhard. I think that the thought of going with the garrisoned rail mobile and increasing our submarine force has to be looked at—I think that Mr. Woolsey agrees with that—as a possible lower cost alternative to going with the small ICBM.

Senator THURMOND. So, as I construe your position, it is that you would go forward with the Peacekeeper?

Dr. HICKS. Yes, sir, one way or the other.

Senator THURMOND. And discontinue the Midgetman——

Dr. HICKS. Correct.

Senator THURMOND. Do you feel that would be the best in the end?

Dr. HICKS. I think that would be best considering the money constraints we have and the situation as I believe it exists.

Senator THURMOND. I have no more questions, Mr. Chairman. Thank you very much.

Senator EXON. Senator Levin.

Senator LEVIN. Mr. Chairman, the request of the administration here for two new systems, in effect, two new land-based systems, addresses a vulnerability which does not exist, except theoretically, and a political perception that some describe, which I believe is exactly the opposite—the real political perception is that we have too many nuclear weapons and not that we need more—and, as a result, uses money that we need for a real vulnerability, which is on the conventional side. That is very deeply troubling to me.

To put $40 billion into one system and $10 billion or $20 billion into another system, which we do not need, when we have real conventional needs, which drive us to rely more and more on nuclear weapons seems to me to be picking exactly the wrong route.

Let me take your assumption, Jim, that we're vulnerable somehow or other, that there is a vulnerability out there in terms of survivable nuclear weapons.

Let me say how can you add more invulnerability in a way which is likely to stay invulnerable. You could add three new Tridents for less then $10 billion, have $30 billion left for conventional, and address the massive conventional needs that we have.

Then your suggestion is, you have to hedge against that Soviet antisubmarine possibility that is unforeseeable now, somewhere down the road. It seems to me that there are two answers to that.

One is that the evidence we have been receiving is that the oceans are more opaque, and not less; that our subs are becoming more survivable, not less. We cover, I think, something like ten times more ocean or at least a huge mathematical percentage more of ocean with the D–5 than we can with the C–4, and for other reasons, our subs are becoming more invulnerable and the ocean is becoming more opaque and not less. This is factor one.

Factor two is if, in fact, there were a breakthrough in ASW, to which a Midgetman could be the answer, we would, presumably, have a few years' notice of that. I mean, that does not happen overnight either. We could then build a Midgetman, if, in fact, the Midgetman were the answer. I happen to agree with Dr. Hicks that it is far more likely, or at least somewhat more likely that the Midgetman would become vulnerable than that the subs would become vulnerable.

So all of that, to me, is an unlikely scenario also.

But I just think that our priorities are screwed up here. Basically, we are talking about two new land-based systems to meet a vulnerability which is allegedly a political one, not a military one. And I even contest the political one. I think the political perception is that we have too many. We ought to find a way to have fewer nuclear weapons.

I don't run into too many people who bang into my office and say gee, our land-based systems are vulnerable. They can drop 2,000 nuclear warheads on the West and wipe out those 1,000 Minuteman silos, and gosh, Senator Levin, all we would have left is enough subs to blow up the Soviet Union 23 times.

I don't have too many people telling me that is our vulnerability.

But I have a lot of people who say aren't we just more and more driven into relying on nuclear weapons by the conventional disparities that are real and perceived?

That is the real military world out there, it seems to me.

ARMS CONTROL ISSUES

Now for my question: it concerns arms control issues.

Where is Midgetman without some limit on the SS–18s, and on the other systems?

We saw charts this morning that show that Midgetman would soak up all the 308 SS–18s. How about if there were 608, or 908, or, 1,208? How about if there were 20 warheads per SS–18, instead of 10, or 30 warheads?

Could you tell us how that would affect the survivability of Midgetman in your opinion, because you seem to be the advocate, at least at that end of the table, for Midgetman, Jim?

Mr. WOOLSEY. Let me address very briefly several things that you said. That was a very thoughtful point, Senator Levin.

I agree that the vulnerability does not exist today. We are talking about something that is a hedge against a possible problem in the future.

I agree that we don't need more land-based warheads. Indeed, with these two programs, one is probably talking about coming down in numbers of land-based warheads, from well over 2,000 to perhaps 1,500, if you have 100 MXs or perhaps only about 1,000, if you have 50 MXs and 500 small missiles.

I agree conventional improvements are important. I have my own personal answer to that, which has to do with increased revenue for the United States. But you did not call me here to testify about that issue.

I believe that deploying Trident does not hedge against the anti-submarine warfare that I described. It may well be that the oceans today, from the U.S. point of view, are sufficiently opaque or are even getting more opaque. But this ASW area is one to which the Soviets are devoting a tremendous amount of effort and in which they have a very large number of very quiet, new, attack submarines. It is a problem that we need to concentrate on much more than we have in the past.

On arms control, I believe that the survivability of a small mobile ICBM would benefit in principle from some sort of ceiling on Soviet throw-weight. But I believe it is so difficult for the Soviets to deploy enough throw-weight effectively to threaten the force, and it is sufficiently easy for us, if they did that, to deploy on additional bases or in additional parts of the country, that it would be unlikely for them simply to add numbers of SS–18s in order to put the small mobile at risk.

It is a low payoff tactic for them.

But, in principle, certainly there is nothing inconsistent between an arms control agreement, putting a ceiling on Soviet throw-weight or warhead numbers of roughly some yield, and it would be, in principle, of some assistance to small mobile survivability.

Senator LEVIN. My time is up.

Thank you.

Dr. HICKS. May I make a comment?

Senator EXON. Yes, Dr. Hicks.

Dr. HICKS. I concur, really, in most of the things you said about that issue.

I think we must be careful, though, as we go into putting money into CDI and the conventional areas that we recognize we have a lot to do and that for a long period, for as long as I can foresee, while we do that, we must rely upon our strategic nuclear force to prevent anything from happening.

So we have to maintain that capability, but I certainly agree that I would trade off the $50 billion on the small ICBM for the conventional area without hesitation.

Senator LEVIN. Thank you.

Senator EXON. Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

Dr. Hicks, how much will it cost the Soviets to increase their inventory of SS–18s from 300 to 600?

Dr. HICKS. Senator, I cannot give you an exact cost. I do know that, typically, the Soviets crank out things. Once they start into production, they have factories, they have people trained, they have a problem in that kind of society with turning things off, not

turning them on. They have made a decision, of course, to also go to the mobile systems.

But I have seen no sign in my lifetime of the Soviets ever stopping building something they felt they needed.

So I don't think that the next 300 SS–18s are going to be a major problem to them in their budget concerns.

A much more important problem to them, for example, would be the fact that when we have ATB, they have to spend an enormous amount of money in air defense if they want to try to cope with that. That is incredibly more expensive for them than the next 300 SS–18s.

Senator WILSON. Or even the next 600?

Dr. HICKS. Or the next 600.

Senator WILSON. Or the next 900?

Dr. HICKS. Or the next 900.

Senator WILSON. I think that was a very interesting question Senator Levin asked.

I guess my next question to Mr. Woolsey would be this. I think what he is really addressing is cost-effectiveness at the margin.

Shouldn't the small missile be cost effective at the margin?

Mr. WOOLSEY. Yes, I believe it should be, Senator Wilson.

Senator WILSON. Well, by what stretch of the imagination can it be, given the setting? Also, would you explain what you mean when you say that you don't think that it would pay the Soviets to devote an increased inventory of SS–18s to knocking out the small missile. We are talking about what you just described as low payoff. I hear you say it, but I did not understand why.

Mr. WOOLSEY. Principally, Senator Wilson, because I believe it would be considerably easier for us to deploy a small mobile force to other parts of the country and, thereby, significantly expand the land area which the Soviets would have to barrage, and less costly than it would be for them to add to their SS–18 force.

SMALL ICBM FLEXIBILITY

I believe that it is also the flexibility of the small ICBM in being able to be deployed in different types of land areas and different types of bases that is——

Senator WILSON. Well, let me interrupt you there, because you said it would be easier, and I think you said more cost effective for us to expand the inventory of small missiles, the Midgetman, than for them to expand their inventory of SS–18s. I understood you to say earlier that it is significantly cheaper to produce and deploy a fixed, land-based missile than one that is mobile. And, clearly, all the evidence that anyone has, indicates there is a significant difference.

Mr. WOOLSEY. If we were trying, Senator Wilson, merely to add warheads with the small mobile, then—I have not run the cost numbers on SS–18s being stamped out in some of these numbers being thrown around here, such as 600, 900 and so forth—compared with keeping a small mobile line going, once you have the base, infrastructure and so forth, I don't know how that one comes out.

What I do believe is that the way the United States would seek to operate, if the Soviets vastly increased the numbers of their SS-18s—going from 300 to 900 effectively doubles the overall throw-weight of the entire Soviet ballistic missile force, so that is not a minor matter—if the Soviets undertook something of that sort, we would not try to match them warhead for warhead with the small mobile ICBM. I think what we would try to do would be to deploy a sufficient number that we still had reasonable confidence that we had some decent survivability, and we would deploy significantly added numbers, if we needed to, in order to put their SS-18 silos at risk in some other way—perhaps with a rail-garrison MX, perhaps with Trident.

Senator WILSON. Well, it seems to me, as we try to grow both, the Midgetman and the SS-18, the cost-effectiveness at the margin criteria increasingly works against us developing the Midgetman.

Dr. Hicks, what do you think?

Dr. HICKS. Well, we certainly can run out of area.

Let me just say since I don't know, as I just said exactly what we can put down for the SS-18, I will make an assumption that it is like Peacekeeper, and probably that is not too far off. We could have about a thousand Peacekeepers for on the order of $40 billion. That is, we could buy 1,000 Peacekeepers in such as Minuteman sites, for example, for the same price as the small ICBM.

Now, if you talk about them doing that for the SS-18, of course that means we have to have something on the order of three times the area.

We could try to find ways of doing that, but that complicates the problem. We are having enough trouble finding ways of putting them into the southwestern United States. That is why we are proceeding to put them into Minuteman garrisons. So you start to triple the areas that people want to give up and you worry about the governors of the various States—and, by the way, it was not just cost that drove the Air Force to put them in the Minuteman garrison. It was also the issue of people crying about them taking over their part of public land that was being used for something else.

It was getting to be a really interesting problem of priorities between agencies about who has what land for what reason. If you use that land for small ICBMs, where goes the bombing range, for example, or whatever.

Mr. WOOLSEY. If the Soviets were so strategically benighted as to devote vast resources to deploying vulnerable systems—SS-18s, in silos—while the United States was deploying hard-target killing mobile systems, then I suppose, under that set of assumptions, in that world, it is equally rational to assume that the United States would find it reasonably easy to find several more regions of the Southwest into which they could flush mobile ICBMs.

Senator WILSON. Mr. Chairman, I will yield because my time has expired. But I disagree strongly with Mr. Woolsey. He is a Californian, I think, orginally. At least I know he is a Stanford graduate.

Mr. WOOLSEY. I'm an Oklahoman.

Senator WILSON. An Oklahoman, all right.

I think that Dr. Hicks has been a bit more perceptive about the politics of the thing. I think you would find any number of people

for any number of reasons objecting. I don't think it would be at all easy.

Perhaps we could accommodate it in terms of sheer geography. But accommodating it otherwise I think could be a good deal more difficult. I think we might hear a lot more from the governors even than about the Guard.

But the other point is that I think there is a vast disparity between the United States and the Soviet Union in terms of the geographic ability and the political ability not only to physically accommodate, but to hide, to conceal mobile missiles.

Also, I would have to make the observation, Mr. Chairman, that I think that a president of the United States who receives strategic warning would, in fact, be viewed on all sides as derelect if he did not disperse nonalert bombers and send to sea those submarines that were in port, and I would suggest as well flush not just the rail mobile, but the small mobile missile. He might then go to the opera.

Senator EXON. Thank you, Senator Wilson.

With regard to the perception of the people from Oklahoma, as a Nebraskan, we have found them very perceptive, at least in one area, from time to time, in November. I don't know how far their perception goes beyond that.

Mr. WOOLSEY. It's mutual respect, Mr. Chairman. Mutual respect.

Senator WILSON. Who was more respected this fall?

Senator EXON. Now, I have the floor.

I am going to recognize our good friend and colleague from Tennessee.

Before I do that, though, I would like to respond, Dr. Hicks, to one of the things that you said.

I believe that I am the only Senator who has been around these tables today who has Minuteman IIIs deployed in his State. As you probably know, this Senator was violently opposed to the placement of MX missiles in those vulnerable silos. But that had nothing to do with their location in Nebraska, because I don't believe that a 10-bird warhead in a silo in Wyoming is any safer than in a silo in Nebraska or anywhere else. So I violently opposed that program because I thought it was fixed and very vulnerable.

However, I am quite attracted to the rail-garrison system because I think it gets to the basic concept, and it is still the basic concept that many people have overlooked during all of these years of toil, torture, and turmoil, that the MX was designed for a mobile missile. I think it makes sense as a mobile missile. I think it gives us a great deterrence.

That is why I am attracted to it.

It is true, though, as you say, that you always run into opposition anywhere you locate things like that. That is why I am particularly attracted also to the concept of keeping missiles on bases and use them off bases only in times of warning. Then I think we satisfy most of the opposition that the other types of basing modes deploy.

With that, I am pleased to recognize now Senator Gore.

Senator GORE. Thank you very much, Mr. Chairman.

First of all, the question was asked earlier about the possible advantage of the Soviet Union having such a large land area. The amount of area needed in order to render a system relatively invulnerable to attack is relatively small. In fact, no more than 10,000 square miles are needed to render the Midgetman invulnerable to attack from an arsenal twice the size of the current Soviet arsenal, and 10,000 square miles is a very small parcel of land, compared to the amount of lands we have on even a small percentage of the military bases that we have in this country.

MISSILE COST EFFECTIVENESS

On the question of cost effectiveness, I followed the questions of my colleague from California very carefully, and Mr. Woolsey's response, I think, is the correct one; that we would not necessarily want to build more Midgetman missiles but, rather, generate more area in a very cost-effective way.

I will just make this point briefly, Mr. Chairman. It is interesting that the cost-effectiveness argument is here accurately applied to the Midgetman system. The cost-effectiveness criterion, as it has been applied to SDI, is used to measure an additional increment of offense versus the cost of defense that might be necessary to render it moot, and you play them one off against another.

In that kind of race, Midgetman has a tremendous advantage.

SDI, by contrast, if you are looking at putting up 10 more space-based orbiting platforms in order to generate an extra increment of defense, there the cost-effectiveness race is really against you.

But I agree with those who say that arms control would be very beneficial to help render Midgetman survivable against a possible expansion of Soviet SS–18 warheads. Indeed, the President has said repeatedly that arms control would be necessary and essential to render SDI effective in the same sorts of circumstances.

The key difference is that the degree of arms control that would be required to render Midgetman survivable on a continuing basis would be far, far less than the degree of arms control necessary to render SDI continually cost-effective and sensible.

Mr. Chairman, the ranking member of this subcommittee, Senator Thurmond, posed three choices earlier. As he said, we could choose MX, we could choose the small ICBM, or we could choose both. There is a fourth choice, and that is that we could choose neither.

If the Senate makes a decision to cut out Midgetman and the House makes the expected decision to cut out MX, the most likely outcome is that neither will be deployed.

Just as Solomon gave two mothers a choice between cutting the baby in half or not, and determined the worthy mother or the real mother by the response of each, it is interesting to me that many in the Pentagon today in OSD, such as Fred Ikle, say neither would be fine with them: just destroy the prospects for either one of them and have no ICBM modernization at all.

I think that is a very revealing response on their part.

I would like to analyze the other three, briefly, Mr. Chairman.

If we decided to just go whole-hog with MX, Secretary Hicks posed the possibility in one hypothetical of buying 1,000 MX. Who

here believes that is politically possible? It is not even possible at this stage to buy 50 additional MX. And, really, the administration is not requesting that.

It is requesting only research to study this new basing system, leaving open the possibility that it might be used for rebasing the first 50 already purchased.

I believe that could make sense.

But I also believe that it is essential to point out that we don't know at this point that it does make sense. We have to do those studies first.

As General May pointed out earlier today, we need the answers to those questions, and it would be premature to make a decision for terminating Midgetman before we had those answers.

Now for the second choice, going for the small mobile missile. I will not belabor this, but we have had three blue-ribbon, bipartisan studies, and they have all come to the same conclusion. All of my colleagues know that I am in favor of that choice.

What about choosing both? I believe that that is feasible. Indeed, I am prepared to support that outcome.

But if we continue on the current path, as I mentioned, I believe the most likely outcome is neither.

Now, finally, Mr. Chairman, Secretary Hicks a few minutes ago responded to the statements I made concerning the destabilizing effect of a presidential decision to flush the rail-garrisoned MX in a crisis. Midgetman would not have to be flushed because it only needs tactical warning.

But here is the point I was trying to make, Secretary Hicks.

You made the point that those missiles would hold just as many Soviet missiles at risk, whether they were in garrison or flushed. I understand that point. I accept that point.

But here is the point that I am trying to make, and I hope that you will see my point.

Inside of 1 hour, the Soviets can destroy 50 MX missiles with about 35 to 40 SS–18 missiles. After that, the MX cannot be readily destroyed by the Soviets, but still continues to hold at risk thousands and thousands of their ICBM warheads.

So, when they compare the balance of forces during the first hour with the balance of forces after the first hour, the military advantage shifts. And when they make a choice, if they anticipate that the crisis is worsening so rapidly that it will come to blows at some point, and they have to choose between going sooner rather than later, that difference in the degradation of their military capability could be the pivotal factor in the crisis.

Do you understand the point I am trying to make?

Dr. HICKS. Absolutely. I understand what you are saying, sir.

I think that there are so many other issues that they have to contend with with us that that would not really lead to that perception; that their perception would be that we are not trying to do something that improves our capability to first strike. It certainly decreases their capability to first strike us. But at the same time, they don't know that we are not going to launch on tactical warning if they play that game.

So you can go on and on and on with these things, and they evolve, and it almost becomes a matter of our opinions.

I have to say that I find I am more in tune with what Senator Levin said today on this issue than I expected to be. I think he is absolutely right that we don't have that kind of problem; it doesn't exist; and that ultimately we have to have strong, offensive capabilities to maintain what I consider to be a stable deterrent situation.

Senator GORE. Secretary Hicks, do you support SDI for the purpose of complicating a Soviet attack against our missile silos?

DEFINITION OF SDI

Dr. HICKS. Senator Gore, you gave me a new definition of SDI this afternoon that I had not heard before.

The definition of SDI that I supported, I guess—and I'll tell you why I support SDI, if you want to do that here or anytime—but the SDI that I know is the so-called total area capability.

Now, I support outside of SDI, or if I happen to need SDI technology, I will support that too, the capability of having some point defense capability. I think that is important. It gives you one more area of deterrence.

Senator GORE. Why? If you always have the option of launching on tactical warning and you have the ability to flush in a crisis, why do you need point defense?

Dr. HICKS. The arguments are no better than the arguments for a small ICBM. I grant that.

Senator GORE. But in one case you attack and in the other case you defend.

Dr. HICKS. No. No. It's a question of moneys.

The fact of the matter is if that point defense, if that active defense——

Senator GORE. Do you think SDI is likely to be cheaper?

Dr. HICKS [continuing]. If that active defense system, the active defense point system—now, I am not talking about SDI—was comparable to anything that was very large, I wouldn't support it. Absolutely. I don't think it would be necessary.

Senator GORE. Mr. Chairman, thank you for your courtesy throughout the day.

Senator EXON. Thank you.

I listened with great interest, Dr. Hicks, to your statement about point defenses, and I agree with you. Maybe that is one of the reasons that you were not selected for the position that I felt you should have been selected for.

I want to thank both of you for being here. We are going to close this hearing. But there is one more question that my colleague from California would like to ask. So I recognize Senator Wilson for that purpose.

Senator WILSON. Thank you very much, Mr. Chairman.

LAUNCH ON WARNING

Actually, I think that our announced policy is not one of launch on warning. So I think that part of the answer to Senator Gore's question is that a defensive capability does not require that you agonize about launching on warning.

But let me ask you a different question.

Senator GORE. Would the Senator yield on that point briefly?

Senator WILSON. Briefly.

Senator GORE. Well, I agree that that is not our policy, and I also agree we should not go toward that policy.

He raised it as the ultimate——

Dr. HICKS. No, I raised it as a concern of the Soviet planner who has to assume it might happen.

Senator GORE. Thank you.

Senator WILSON. Let me ask you this question.

MISSILE MODERNIZATION

This really has to do with our missile modernization rather than SDI. But it has arisen in that context, because so many of the critics of SDI, who are eager to propound ways in which it can be easily and cheaply defeated, have suggested that, among those, is that kind of space-based or boost-phase element could inevitably be defeated cheaply and easily by the Soviets simply moving to the expedient of developing a fast burn capability for their launch.

Could you tell me how easy, how early, and how cheaply you think that capability can be achieved, either by the Soviets or by the United States, Dr. Hicks?

Dr. HICKS. I am not an expert in this area, Senator Wilson. So I will tell you what I believe.

I think it is quite difficult to do. We would find it difficult. It changes lots of things in that ICBM system. But I don't think it is impossible to do at all. It can be done.

The question really is what can you do, what can your sensor systems do to handle that. What is your time line in response to that?

I think the whole research activity in SDI is there to find out what we can do. And if SDI did not eventually consider those kinds of threats and try to figure out how they could resolve it, then, of course, it would not be doing its job.

I see SDI as an incredible opportunity for us to put massive numbers of engineers and scientists on very high risk, tough problems that can lead to amazing breakthroughs, not only, frankly, just in the area of missile defense, but other areas. I believe that the real reason the Soviets are so concerned about this is perhaps less the problem of whether they can overwhelm SDI or not by their advantage, but their historical view of what happens to this country when we had that kind of massive effort on high risk problems and how successful we have been in coming up with very important results.

Senator WILSON. Thank you.

Senator EXON. Well, I said that was the last question, but I must ask one more question, which was prompted by the exchange that just took place.

I also am a supporter of SDI, and have been from the beginning. But I think that we are misleading the public in some of the recent attitudes that we seem to have taken in some places in the administration that we are about ready to deploy the beginning of something, when I can find no basis for that in fact, whatsoever.

The other perception that is being spread about is that the public is being misled along the lines that SDI is a totally, completely, defensive system, with no offense in it at all.

From the experience that both you gentlemen have, do you honestly believe that we can proceed with the development of SDI without having somewhere a relationship between both offensive and defensive systems? Can we really separate between offensive and defensive?

Isn't it true that we are very likely, if we are going through the research that we are going through now, that we are going to discover as many offensive systems as we are defensive?

Dr. HICKS. If I may start, I think that is certainly true. I hope it is true, because it is my belief that our offensive capability is what we use for deterrent.

We have none of the reasons and desires to do certain things that the Soviets might do. So, to me, to have our offensive capability increased is all to the good.

I think that the people in SDI, as they proceed with their research, aren't thinking in that direction. They are certainly thinking in terms of what their overall goals are, which is defense.

Let me give an example.

Senator EXON. Don't you think the President himself, Dr. Hicks, is putting out the perception that this is a defensive system and a defensive system only?

Dr. HICKS. I think that in his view of how the system will be deployed, it is that. That does not mean that things that come out of the research, in my mind—and I don't know, I can't speak for the President, I have no idea how he thinks about this—but there is no question in my mind that some of the research is going to lead to what I consider to be valuable, offensive capabilities.

An example is that as we learn things in terms of kinetic killers, they might be very, very successful for us in the armor, anti-armor situation conventionally. So I think it would be outstanding if that happened. It would be another reason to support it.

Senator EXON. Thank you.

Mr. Woolsey.

Mr. WOOLSEY. I think the supposition that you and Dr. Hicks essentially shared is correct, as long as the work is kept at a relatively early stage of research and development prior to something like full-scale engineering development.

Once one goes into full-scale engineering development of a system, pointing toward deployment, it tends to get relatively frozen in concept and purpose, and I think the applicability of the work to other technologies and other applications is less likely. It is one reason why I have also thought that the research and very early development work of the sort, some of what is proposed, by the SDI, is well worth pursuing.

Senator EXON. You see, the more we talk, the more points come up.

Senator Gore would like to make one more point, so I recognize Senator Gore for one more point.

Senator GORE. I hope it does not provoke two or three other comments.

I was listening to the Chairman point out a current misconception, and it occurred to me that all of the discussion we had today about the ability of the Soviets to overcome passive defenses by deploying more SS–18s also applies to SDI.

We talked about the fast-burn option, but simply deploying more missiles might well be extremely cost-effective. In fact, every study at this point shows that it certainly would be.

Here is the point I wanted to make, Mr. Chairman. The so-called boost-phase advantage is that a space-based system could knock out a missle before the MIRVs separated. But there is a thing called the "absentee ratio" which means that for every space-based platform that is on station, above the Soviet Union, capable of striking during boost-phase, there have to be at least three other expensive platforms that are elsewhere in orbit on the other side of the earth, and so the cost ratios of that offense-defense interchange are not all in favor of the space-based platform by any means.

I would argue very strongly that when the studies are in, this Nitze cost-effectiveness criterion is going to be very, very hard to overcome.

Senator EXON. Dr. Hicks, Mr. Woolsey, you have been very patient and very responsive to our questions. We have appreciated very much your coming up here and in total thanks to you, we are now adjourned.

[[Whereupon, at 4:21 p.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

TUESDAY, MARCH 10, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC
FORCES AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

STRATEGIC POLICY AND ARMS CONTROL ISSUES

The subcommittee met in open session, pursuant to notice, at 4:14 p.m. in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Levin, Gore, and Thurmond.

Staff present: Patrick A. Tucker, minority counsel; Robert F. Bott, John J. Hamre, William E. Hoehn, Jr., and Ronald P. Kelly, professional staff members; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Donald A. Mitchell, assistant to Senator Glenn; Leon Fuerth, assistant to Senator Gore; James M. Bodner, assistant to Senator Cohen; and Henry D. Sokolski, assistant to Senator Quayle.

OPENING STATEMENT BY SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order, please.

Dr. Ikle, we welcome your appearance before the subcommittee this afternoon to offer us some insights into our strategic policy and related arms control issues. We have just heard from Ambassador Paul Nitze, and I know that you were here when he started and you listened to that whole presentation.

We look forward to your attempt to place in a unified context the administration's ongoing strategic modernization program, its research program on strategic defenses, its strategic policy and doctrine, and its arms control policy. That sounds like a tall order, and we are starting off late, but we appreciate your patience.

Before we proceed with your testimony, Dr. Ikle, let me invite our distinguished ranking minority leader, Senator Thurmond, to offer some words of welcome.

Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman. I want to join you in welcoming Dr. Ikle this afternoon. It is a pleasure to see you again, Doctor.

Dr. Ikle, from your vantage point as Under Secretary of Defense for Policy, you have a unique perspective on the strategic issues we will be considering this year. I look forward to your testimony this morning to provide the context in which we will be making our budget recommendation.

Dr. Ikle, last Friday this subcommittee had a full day of hearings on the mobile ICBM program. It was a full and productive day and one for which our chairman deserves much praise for seeing to it that the critical issues received a thorough discussion. Several questions emerged from the testimony.

First, given budgetary pressures and our overall conventional and strategic priorities, can we afford the small ICBM program?

Second, should we, as a matter of policy, abandon the planning criterion for ICBMs that emphasizes the "bolt out of the blue" attack?

Third, assuming that strategic warning indicators will be available, will political leaders act on them to disperse forces for survivability and would that action be stabilizing or destabilizing?

Fourth, does the current basing configuration for the small ICBM, that is hard-mobile launchers deployed at Minuteman sites, result in a distinction between the small ICBM and rail-garrison MX basing with respect to the strategic warning response issue?

Dr. Ikle, I will look forward to your testimony today to shed additional insights into these important questions. I further look to your testimony to provide the connection between our strategic force modernization program, the Strategic Defense Initiative program, and our arms control policies and negotiating positions.

Finally, I would like to note that one of the greatest challenges facing policymakers in the next few years is in managing the transition from sole reliance on nuclear weapons for deterrence to an increasing dependence on strategic defense.

Dr. Ikle, your insights on this transition and what the Department of Defense is doing to plan for it and to assess its implications would be most welcome.

Thank you, Mr. Chairman. Thank you very much.

Senator EXON. Thank you.

Dr. Ikle, would you please proceed?

STATEMENT OF HON. FRED C. IKLE, UNDER SECRETARY OF DEFENSE FOR POLICY ON STRATEGIC POLICY

Dr. IKLE. Mr. Chairman, I appreciate this opportunity to continue the dialogue on the strategic posture which began last Friday which Senator Thurmond mentioned. You heard about specific details of strategic programs as well as about strategic warning questions. I propose to take a broader perspective today to discuss how these programs relate to our larger national objectives.

In your decisions, Mr. Chairman, on each of the proposed systems, you need to compare its contribution to our strategic objectives and its costs. To allow sufficient time for your questions and discussion, I shall limit my remarks to three points and then perhaps in the question period I could turn to some of the other issues, some of the issues mentioned by Senator Thurmond, for example.

The first point I wish to make is that we need to weigh carefully a range of threats as we design our strategic forces so as to cover all plausible contingencies. While each system does not have to meet every plausible threat, the totality of our strategic system does. Hence, we need the balance and coherence.

If in trying to solve one certain weakness in one system we divert too much money from the other systems, we might increase the overall risk. Our strategic modernization program began in 1981 and has been broad-gauged to cope with the many different demands that our strategic forces must meet for years to come.

Most importantly, we have been improving and continuing to improve the command, control and communications system for all strategic forces. Without survivable command/control systems, none of our offensive forces could serve their intended purpose.

In addition, we must pursue the Strategic Defense Initiative. It is only with strategic defenses that we can eventually reduce our dangerous total vulnerability to any kind of nuclear attack, large or small, launched by design or by accident.

ICBM MODERNIZATION

Let me now turn to the modernization of the ICBM on which you touched, which you discussed last Friday, Mr. Chairman. The administration has moved forward, as directed by Congress, with basing proposals for both the Peacekeeper and the small ICBM. It is now most important for the Congress to decide how these two ICBMs compare and whether both should be continued. In accordance with the congressional mandate, both missiles are in the President's budget.

You were told last Friday that to deploy 500 warheads with the small mobile ICBM would cost three to four times as much as to deploy the same 500 warheads with the Peacekeeper based in the rail-garrison mode, and in the situations for which the deterrent capability of these two mobile systems would be most critical, say a major U.S./Soviet crisis or a conventional war, the warheads deployed on Peacekeeper would be at least equally survivable as the three-to-four times more expensive deployment of the small ICBM.

Obviously, the additional funds necessary to deploy the small ICBM would compete with other strategic programs or with other parts of the budget.

"BOLT FROM THE BLUE" ATTACK

One argument used against the rail-garrison Peacekeeper must be addressed. Senator Thurmond raised it just now. Critics have charged that the system is vulnerable to a "bolt from the blue" attack. This is my second major point I want to make in this opening statement. Our strategy of deterrence is designed to influence rational decisions of the Soviet politburo.

No matter how many ICBMs we deploy, we cannot deter an irrational or accidental attack, but given the enormous risks of any massive nuclear attack by the Soviet Union on the United States, it is farfetched indeed to argue that Moscow could rationally decide to launch such an attack without provocation and preparation.

If the decisionmakers in Moscow were attempting to risk this cosmic gamble——

Senator EXON. Let me interrupt you. Would you go back a couple of sentences and repeat that—I want to make sure I heard you right.

Dr. IKLE. I would be pleased to do that.

Senator EXON. Something about a "bolt out of the blue."

Dr. IKLE. I am discussing here the question of the "bolt out of the blue" attack, the attack that comes suddenly in the midst of a normal peacetime situation, and I made the point that our strategy and deterrence are designed to influence rational decisions of the Soviet Union because no matter how many ICBMs or other offensive weapons we have, we cannot deter or prevent an irrational or accidental attack with these offensive weapons.

However, given the enormous risk of any massive nuclear attack by the Soviet Union, it is farfetched to argue that Moscow could rationally decide to launch such an attack without provacation and without preparation.

To put the same thing in different words, Mr. Chairman, if the decision makers in Moscow were tempted to risk this kind of cosmic gamble and launch a massive attack out of the blue, if they were tempted to suddenly launch this all-out attack, that for a host of reasons might fail to disarm the United States and hence cause the destruction of the Soviet Union, if Moscow's leaders were so tempted, Mr. Chairman, then their rationality would be so degraded to the point where another 500 ICBM warheads would not help us.

Put differently, if they throw away all the calculations about the risks, our adding 500 warheads to these risks would not affect their irrational decision.

Now, in contrast to this "bolt out of the blue" scenario, the possibility of a conventional Warsaw Pact war that we must consider, in that possibility our strategic deterrent would be, indeed, under greatest stress because the Soviets would have to consider our NATO strategy, that we might use nuclear weapons first in the event our conventional defenses fail, and they might then be tempted to take the gamble to preempt this first use by the alliance.

Now, this is the time when an effective survivable ICBM force could make a crucial difference. This, of course, is the time when the rail-mobile Peacekeeper would be fully dispersed and hence highly survivable; or, in short, when we need this addition to our offensive forces for ICBM modernization. In that situation, the rail-mobile Peacekeeper deployment mode would be a highly survival deployment.

Now, the question has been raised, and again Senator Thurmond touched on it, whether the dispersal of the Peacekeeper from the garrisons to the national railroad net might not be provocative or destabilizing. The answer is that, on the contrary, such dispersal could be stabilizing. We need survivability for a second strike. One does not need survivability for a first strike.

Thus, by putting our ICBMs onto a survivable mode, moving out from the garrisons, we indicate that we are better prepared to

strike second, which is what we want for stability, so we would be increasing stability.

Incidentally, Senator Thurmond, the idea of dispersing our military assets is common. It is a common procedure. It applies to submarines, aircraft, prepositioned stocks in Europe, as well as to Pershings and GLCMs. Incidentally, it also applies to the small ICBM that would be dispersed upon warning.

Now, please mark, Mr. Chairman, I am not saying here in discussing the "bolt out of the blue" or the accidental attack that we need not be concerned about an accidental or an irrational attack. Indeed, I believe, Mr. Chairman, for the long term we ought to be deeply concerned about such a possibility, but given that we cannot prevent an accidental or irrational attack from taking place by threatening retaliation, there is today nothing we can do against such an attack from inflicting severe harm on the United States.

If we had an effective strategic defense, however, we could at least reduce the amount of destruction that this would cause or perhaps prevent destruction entirely. So if one is concerned about the problem of an irrational or accidental Soviet missile attack, an attack out of the blue, one should support SDI. ICBMs, whether small or large, small ICBM or Peacekeeper, will not help for this contingency.

Let me move to the third point that I wish to address, which is the alleged inconsistency we sometimes hear about between our START position requiring that mobile missiles be banned and our advocacy of mobility for the Peacekeeper ICBM or for the small ICBM.

Now, the logic which links these two positions is quite straightforward. If you are unable to achieve the deep reductions that we seek in START, we would not have been successful in our attempt to decrease the Soviet threat to our deterrent forces. So we want our system to be deployed in a manner that best enables them to survive. Mobility here would be the answer if we don't have an agreement.

If, on the other hand, we are successful in negotiating the kind of START agreement that the President is trying to get, the Soviet nuclear threat will have been reduced significantly, but, and this is crucial, that will only be true if the agreement is complied with and verifiable. Mobile systems, if permitted, under numeric limits are extraordinarily difficult to verify.

If the Soviet Union were determined to cheat, it could deploy covertly perhaps as much as 200 percent over the allowed limit without the United States acquiring unambiguous evidence. The effect of such violation would be particularly dangerous precisely in the deep reductions regime, but with a ban on mobile ICBMs, verification becomes much easier.

So accordingly, we are prepared in a START agreement to forego mobile ICBMs in order to prevent the Soviet Union from deploying them. Whatever loss we might suffer in overall stability from not being able ourselves to deploy mobile ICBMs would be more than offset by what we would gain in stability by precluding massive, unverifiable Soviet cheating on ICBM limits.

So that is the rationale for this dual position of wanting mobile ICBMs now for ourselves but envisaging in a START agreement of 50 percent reductions to do without the mobile ICBMs.

Mr. Chairman, I know there are questions, and maybe it is better if I stop here and return to those and reply to the Senators.

[The prepared statement of Mr. Ikle follows:]

PREPARED STATEMENT BY DR. FRED C. IKLE, UNDER SECRETARY OF DEFENSE FOR POLICY ON STRATEGIC POLICY

Mr. Chairman, I appreciate the opportunity to appear before you to continue the dialogue on strategic posture which you began last week. Last Friday, you heard about specific details of some current strategic modernization programs, as well as about strategic warning. I propose to take a broader perspective today, and to discuss how these programs relate to our larger national objectives. In your decisions on strategic systems, Mr. Chairman, you want to be guided by these larger objectives. We don't buy missiles for their own sake. For each proposed system, you need to compare its contribution to our strategic objectives and its costs.

To allow sufficient time for your questions and discussion, I shall limit my remarks to three key points.

I. The first point I wish to make is that we need to weigh carefully a range of threats so as to cover all plausible contingencies as we design our strategic forces. While each system does not have to meet every plausible threat, the totality of our strategic systems does. Hence, we need balance and coherence. If, in trying to solve certain weaknesses in one system we diverted too much money from another part of the strategic program, we would increase the overall risk. You want to keep this point in mind as you decide on the present options for the modernization of the ICBM.

Our strategic modernization program since 1981 has been broad-gauged, to cope with the many different demands that our strategic forces must meet for years to come. We are maintaining and renewing a multiplicity of offensive forces, each with different strengths and weaknesses. But most importantly, we have been improving and continue to improve the command, control, and communications system for all our strategic forces. Without a survivable command and control system, none of our offensive forces could serve their intended purpose. In addition, we must pursue the strategic defense initiative. It is only with strategic defenses that we can eventually reduce our dangerous total vulnerability to any kind of nuclear attack, large or small, launched by design or by accident.

On the modernization of the ICBM, the administration has moved forward, as directed by the Congress, with basing proposals for both the Peacekeeper and small ICBM. It is now most important for the Congress to decide how these two ICBMs compare and whether both should be continued. You were told last Friday that to deploy 500 warheads with the small mobile, ICBMs would cost 3 to 4 times as much as to deploy the same 500 warheads with the Peacekeeper based in the rail-garrison mode. And in the situations for which the deterrent capability of these two mobile systems would be most critical—a major U.S.-Soviet crisis or a conventional war—the warheads deployed on Peacekeeper would be at least equally survivable as the three to four times more expensive deployment on the small ICBM. Obviously, the additional funds necessary to deploy the small ICBM would have to come from some other strategic program or from another part of the budget.

II. One argument used against the rail-garrison Peacekeeper must be addressed, however. Critics charge that the system is vulnerable to a bolt-from-the-blue attack. This is the second point I wish to discuss with you.

Our strategy of deterrence is designed to influence rational decisions of the Soviet Politburo. No matter how many ICBMs we deploy, we cannot deter an irrational or accidental attack. But given the enormous risks of any massive nuclear attack launched by the Soviet Union against the United States, it is far-fetched, indeed, to argue that Moscow could rationally decide to launch such an attack without provocation and without preparation. If the decision-makers in Moscow were tempted to risk this "cosmic gamble" (to use Dr. Harold Brown's apt phrase); if they were tempted suddenly to launch this all-out attack that, for a host of reasons, might well fail to disarm the United States and hence cause the destruction of the Soviet Union; if Moscow's leaders were so tempted, Mr. Chairman, then their rationality would be degraded to the point where another 500 ICBM warheads would not help us.

By contrast, our strategic deterrent would be under the greatest stress in the event of a conventional NATO-Warsaw Pact war, because of the risk of a calculated Soviet decision to preempt a possible NATO first use of nuclear weapons. This is when an effective, survivable ICBM force could make a crucial difference, and this is when the garrison-rail mobile Peacekeeper would be fully dispersed and hence highly survivable.

The question has been raised whether the dispersal of the Peacekeeper from the garrisons on the railroad tracks might not be "provocative" or "destabilizing." The answer is that, on the contrary, such dispersal could be stabilizing. You need survivability for a second strike, not for a first strike. Thus, by putting our ICBMs into a survivable mode, we indicate we are better prepared to strike second, which is what we want for stability. By the way, dispersing our military assets in a crisis is a common procedure; it applies to submarines, aircraft and prepositioned stocks in Europe (POMCUS), as well as to Pershings and GLCMs, and, of course, to the small ICBM.

Now, please mark, I am not saying we need not be concerned about an accidental or irrational nuclear attack. Indeed, for the long term, we ought to be deeply concerned about such a possibility. But given that we cannot prevent an irrational attack from taking place by threatening retaliation, there is today nothing we can do to prevent such an attack from inflicting severe harm on the United States. If we had an effective strategic defense, however, we could at least reduce the amount of destruction inflicted on us, if not prevent all destruction from occurring. So, in light of the problem of an irrational or accidential Soviet missile attack, one should support SDI. ICBMs—whether small or large—won't help for this contingency. We have discussed at other times and on other occasions the reason why SDI will help deter a rational attack as well. The case for SDI has multiple reason.

III. The fourth point I wish to address is the alleged inconsistency between our START position requiring that mobile missile systems be banned and our advocacy of mobility for the Peacekeeper ICBM.

The logic which links these two positions is straightforward and simple. If we are unable to achieve the deep reductions we are seeking in START, we will not have been successful in our attempt to decrease the Soviet threat to our deterrent forces. Hence, we would want our systems to be deployed in a manner that best enables them to survive—and therefore deter—a Soviet attack. Mobility would provide that answer for the ICBM.

On the other hand, if we are successful in negotiating the kind of START agreement the President seeks, the Soviet nuclear threat will have been reduced significantly. But—and this is crucial—that will only be true if the agreement is complied with and verifiable. Mobile systems, if permitted under numeric limits, are extraordinarily difficult to verify. If the Soviet Union were determined to cheat, it could deploy covertly perhaps as much as 200 percent over the allowed limit without the United States acquiring unambiguous evidence, even with most far-reaching verification arrangements. The effect of such a violation would be particularly significant precisely in a deep reductions regime—and would be the source of dangerous instability.

But with a ban on mobile ICBMs, verification becomes much easier. Accordingly, we are prepared in a START agreement to forego mobile ICBMs in order to prevent the START Soviet Union from deploying them. Whatever loss we might suffer in overall stability from not being able to deploy mobile ICBMs would be more than offset by what we would gain in stability by precluding massive, unverifiable Soviet cheating on ICBM limits.

Senator EXON. Let us go into questions. We will follow the 6-minute rule.

It seems to me that you are saying that our nuclear deterrent is undergoing a modernization and you do not believe that the "bolt out of the blue" is as significant a threat as it once was. Is that correct?

Dr. IKLE. I am not stating that there is a change in that threat. I am saying a "bolt out of the blue," except for the following, that the numbers of weapons that would survive any kind of an attack is to date much larger than it was, let us say, in 1950.

"BOLT OUT OF THE BLUE"

Senator EXON. What do you have to say about the "bolt out of the blue" theory?

Dr. IKLE. So, therefore, an attack without provocation and without preparation on the part of the Soviet Union is a rather irrational act, and once you imagine a Soviet leadership making such an irrational decision, almost by definition they are not making serious calculations. Adding 500 warheads, therefore, to our thousands and thousands of strategic warheads is not likely to make much of a difference on that irrational or accidental decision.

Senator EXON. Well, that was not the rationale we were following 10 years ago, though, was it?

Dr. IKLE. Yes. Ten years ago, and that would be 1977, the "bolt out of the blue" was, I think, not considered a dominant threat. The people were properly concerned then as we are today about our deterrent functioning in time of crisis. When there is limited war going on, when there is a conventional war going on, this is when our deterrent would be under the greatest stress.

Senator EXON. Are you telling me, Dr. Ikle, for the record here that there has been no change in our deterrent policy during the last 10 years regarding the "bolt out of the blue" scenario?

Dr. IKLE. We always have to be concerned that if we were negligent, and maybe this is what you are driving at——

Senator EXON. I am not talking about being negligent. I am simply asking you a question as to whether or not in the last 10 years there has been any change in our strategic planning strategy, how we would use weapons, how we would deploy them, how fast we could get our air-breathing leg off the ground.

I remember, and I think you remember, how long ago was it that we thought that the United States of America would have to get START airborne in 17 minutes by our air-breathing leg before we had any degree of security?

Dr. IKLE. There have been changes, you are right. We have improved mobility, and we will, of course, with the introduction of the B–1 bombers, be able to take off rapidly. We have strengthened our command, control and communication to be able to respond quickly, and there have been other changes.

Senator EXON. We just got the B–1. That did not have much to do with it, did it?

Dr. IKLE. It will in the future be helpful in giving us the capability for more rapid take-off.

Senator EXON. I do not think I am getting anywhere with that line of questioning. Let me switch, because my time is quickly running out.

RAIL-GARRISON MODE FOR MX

You are talking about a rail-garrison mode for the MX. Has there been any study done on expanding that further to a truck-garrison mobile plan for the MX?

Dr. IKLE. We have looked at moving the MX, yes, Senator, by trucks. Given the weight, that did not seem to be a practical way to introduce mobility. The rail-bed mode, of course, can cary much heavier weights. That is why the rail mobile is a better solution.

Senator EXON. I wish that you would give us the facts and figures on that. The rail-garrison mode would have how many MXs as part of that train?

Dr. IKLE. We are proposing 50; two per train.

Senator EXON. That is not classified. That is why I asked you that way. I knew the answer. Do you mean to tell me that you could not have one MX move out at relatively slow speed if we were not faced with this "bolt out of the blue" scenario and have deployment on both garrison railroad mobile and truck mobile, like one MX?

Dr. IKLE. It is possible, of course, to move the MX on truck-like vehicles, giant trucks specially constructed on a hard roadbed or with very wide trucks.

Senator EXON. Like an interstate?

Dr. IKLE. Well, I think there you would have difficulty on bridges. We have studied this extensively. I could submit additional information for the record, but one alternative we have looked at is moving the MX among different silos to give it the benefit of what is called deceptive basing.

Senator EXON. That is back to what the President rejected when he ran for office.

Dr. IKLE. We have looked at it again. It is not the preferred solution. I am just mentioning that there are ways of moving the heavier MX missile overland without railroad tracks, but it is a very cumbersome movement.

Senator EXON. All right. You alluded in your remarks about how much we could save with the rail-garrison MX as opposed to Midgetman. Midgetman was three or four times as costly as the MX for the same firepower.

Could you supply for the record the details on the MX, if we wanted the same firepower that we would have with 500 of the Midgetmen, which have been publicly estimated to cost between $40 and $50 billion? How much would it cost us to build the equivalent of rail- or truck-mobile MX?

How much would we save in billions of dollars over their respective lives? Could you get that for us and supply it for the record?

Dr. IKLE. I can give you an off the cuff answer and more detailed figures for the record. We would save about $30 billion.

Senator EXON. Well, that is $30 billion; that is worth looking at. How much could we save by going to additional Trident subs with D–5 missiles instead of Midgetman? Would that not be a significant savings also?

Dr. IKLE. Warhead for warhead, the Trident would be a cheaper deployment, and of course we consider it very survivable. But if you go halfway into, say, the rail-mobile MX system, you already have to pay a lot of the costs for that system. You have to do all of the research.

Senator EXON. Research for what?

Dr. IKLE. For the railroad costs, the operations, and so on.

Senator EXON. Of course, that is one of the things. And my time is up, but I will get at this in the second round. That is one of the things that I remain very confused about. This is supposed to be a system that would be deployed in a simple railcar. It is supposed to fit on a regular size track and all that.

And yet, we are going through all of this song and dance with regard to the research and development. We know how to run railroads. We have been doing it for years. The railroad car that you are going to put this rail-garrison MX in, it will not be significantly different than any other railroad car. We've built, tested, and deployed the MX.

I do not see why we have to talk a great deal about expense for research and development. We did that with the missile. Now we are going to move it around on a train.

Dr. IKLE. You are right in a sense. We have accomplished some research and development on a mobile MX under the deceptive basing plan under the previous administration—this was movement, however, on trucks. We need to conduct some research into the technical requirements of the missile to function on trains. We also need to understand exactly the concept of operations we would employ for Peacekeepers once dispersed on the rail net. This should not be characterized as a major undertaking, but instead the conduct of research that will add the design details necessary for a full-scale development decision next year.

Senator EXON. Let me ask you to also supply for the record, Dr. Ikle, what kind of mix we could expect if we also provided that additional firepower that we would get from the 500 Midgetmen, if we had a mix between some kind of a mobile deployment of the MX and maybe some of them in Tridents with the D–5 warhead.

Dr. IKLE. I shall do that.

[The information follows:]

ICBM MODERNIZATION

Five hundred small ICBMs is equal to 50 Peacekeepers, or some combination (in rough terms) of rail-garrison Peacekeepers and Trident D–5s. The exact makeup of such a mix would depend on many factors.

Senator EXON. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

STRATEGIC COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE

Dr. Ikle, your testimony emphasizes the importance of our strategic command, control, communications, and intelligence. Can you identify any areas where our deterrence policy and our capabilities are mismatched because of C^3 limitations?

Dr. IKLE. Without getting into a classified area, Senator, the concern of controlling our forces, if we cannot properly control our forces we could have an unintended escalation on the one hand, where the intention was to respond in a very limited way but without the control it did not work out that way; the escalation was larger.

Or conversely, the response may not be timely enough. And in particular, if the command and control structure is vulnerable the enemy may be tempted to take advantage of that and attack your command and control structure, rather than your offensive forces.

TRIAD OF STRATEGIC FORCES

Senator THURMOND. Dr. Ikle, there has been some suggestion this year that continued reliance on the triad of strategic forces is as

much a technical issue as a policy issue. Do you agree that we could forego ICBM modernization if necessary improvements are made in submarine ballistic missile accuracy and submarine communications?

Dr. IKLE. If we did that, Senator, we would forego certain advantages that are inherent in the land-based forces. The multiplicity of basing modes is what we want with the so-called triad. In a way, it is really more than three different modes.

Why do we want that? Because it makes the planning of the attack so much more complicated, and if there is a breakthrough in the survivability of the submarines or in the penetration capability or other aspects of our bombers it is advantageous for us to have a third or a fourth way of deploying our offensive forces, so that not all of them will fail at the same time.

So there is an advantage of having land-based missiles.

STRATEGIC BUDGET PRIORITIES

Senator THURMOND. Dr. Ikle, previous witnesses have testified that they would prioritize strategic budget priorities on the basis of first things first, placing Peacekeeper first and small ICBM last. Would you agree with this prioritization, and where do you place SDI research among your budget priorities?

Dr. IKLE. We place the SDI research as one of the highest priorities, because it gives us such a large return on the margin. It is one thing that brings arms control back into the discussion. It has proven to be a very, very important incentive for the Soviets to begin to meet us on arms control issues.

It is apparent that they are much more impressed by our SDI research than by some additional missiles or bombers that we add to our offensive forces.

But apart from that, I would say the priority begins, as I stated in my opening remarks, with command, control, and communication. That is the most important part, because that is needed for all elements of our forces.

And we attach great importance to the B–1 bomber and the ATB, the D–5 missile, and to the ICBM's, perhaps more or less in that order.

Senator THURMOND. Dr. Ikle, do you support the ICBM modernization requirement of about 1,500 hard-target capable warheads? What portion of that requirement calls for the unique capabilities of the single warhead small ICBM?

Dr. IKLE. Well, the number of warheads required would be the same for either the rail-mobile or small ICBM as we expect the effectiveness to be about the same for both missiles against hard targets. The number of targets that would need to be covered that you referred to, however, is not a figure that I could endorse.

But if you needed additional capability for attacking targets, you could, of course, have additional offensive forces of various kinds. You could add to the D–5, you could add to the rail-mobile MX, you could add to the bomber force if that satisfies your requirement.

You are not necessarily driven to switch, say, from the MX, from a Peacekeeper to the small ICBM in order to add another 500 warheads.

PEACEKEEPER VERSUS SMALL ICBM WARHEADS

Senator THURMOND. Dr. Ikle, if only 500 hard-target warheads are available in the Peacekeeper force, would the priorities of our targeting policy permit 500 small ICBM warheads to be planned in a manner that capitalizes on their unique attributes, or would they be planned as a substitute for the deficiency in Peacekeeper warheads?

Dr. IKLE. In simple terms, to keep the discussion unclassified—and I would be pleased to submit maybe additional information for the record—I would say there is not a great technical distinction in the strategic uses between, on the one hand, the Peacekeeper warhead and on the other hand the warhead of the small ICBM.

They could more or less serve the same purpose in the same manner.

Senator THURMOND. Dr. Ikle, you note in your testimony that mobile systems, if permitted under numeric limits, are extraordinarily difficult to verify, and that the Soviets could deploy covertly as much as 200 percent over the allowed limits.

What are the implications of this statement for the ongoing INF negotiations, where the possibility exists that the Soviets would be allowed 100 warheads on mobile SS-20s outside of the European theater?

Dr. IKLE. The implication, as I guess your question is pointing out, is serious, and points out the desirability of the President's position in INF, namely to go to zero INF missiles worldwide. And that is still our preferred position, and hopefully we can still get there, maybe through this stage of an INF agreement that will allow for a while 100 INF missiles, but not indefinitely.

Senator THURMOND. I believe my time is up. Thank you, Mr. Chairman.

Senator EXON. Thank you.

Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

MIDGETMAN AND MOBILE MX

Dr. Ikle, as I understand your testimony you have set forth certain assumptions relative to the Midgetman and the mobile MX, and you have reached a conclusion, which I happen to share, that because of the enormous risk of any retaliation, that it would be irrational for a Soviet planner to launch a "bolt out of the blue" attack, and that deterrence is aimed at deterring rational decisions and not irrational decisions; and that, given the difference between Midgetman and the mobile MX, being that one would be useful against the "bolt out of the blue," but both would be useful against a more calculated Soviet decision following preparation, that you might as well go with the cheaper one rather than the more expensive one.

Is that basically it?

Dr. IKLE. That is a fair summation of that point, Senator.

SOVIET FIRST STRIKE

Senator LEVIN. Now, where I do not know—in fact, where I know I do not agree with you—is on the second premise, which is that a

rationale Soviet planner could calculatingly strike us first, and therefore—well, let me just stop right there.

At the bottom of page 3 of your testimony, you say that: "By contrast, our strategic deterrent would be under the greatest stress in the event of a conventional NATO-Warsaw Pact war because of the risk of a calculated Soviet decision to preempt a possible NATO first use of nuclear weapons."

I presume that calculated is synonymous with "rational"?

Dr. IKLE. Yes.

Senator LEVIN. So what you are saying is that you believe that a rational Soviet planner could, after planning and preparation, hit us first?

Dr. IKLE. Well, the context there, of course, is a major conventional NATO-Warsaw Pact war, which incidentally is the kind of contingency, Senator, as you know, to which the bulk of our budget is devoted. This is the one we take seriously.

Senator LEVIN. But given that event——

Dr. IKLE. Our alliance is built around it. Now, given that event, the forces would be mobilized. There would be preparations. Our forces would be strengthened, of course, because of the alert procedures. So would, we assume, the Soviet forces.

But given also that it is NATO strategy and has been for decades that, in the event the conventional war deteriorated from our point of view, from the alliance point of view, the alliance might use nuclear weapons first.

Senator LEVIN. Might.

Dr. IKLE. Might.

The possibility could arise that the Soviet high command would sense such a decision coming and would want to strike first unless it is very effectively deterred, deterred in a much more massive way than would be needed to deter the "bolt out of the blue."

And this is where the additional contribution of the MX or the small missile comes in.

Senator LEVIN. What you are saying is that a rational Soviet planner could strike us first after we had been alerted to their preparations and therefore we have more of our subs at sea, more of our planes in the air, and presumably our rail-mobile MX out on the rails, that a rational Soviet planner could strike us first?

Would he not thereby not only guarantee retaliation, as he would with a "bolt out of the blue," but guarantee retaliation by twice the force? And how could that be rational if a "bolt out of the blue" is irrational?

And by the way, I love your conclusion that the "bolt out of the blue" is irrational. I could not agree with you more.

Dr. IKLE. The point I was making there is that the added contribution that you have factored in now here in the way of additional ICBMs could be very important. We might have had losses in the submarines. We might have had other losses because of the war that was going on.

So that the individual components of our strategic offensive forces become more important, and therefore the contribution that the ICBM component would make would loom larger than it would against the unlikely or irrational "bolt out of the blue."

Senator LEVIN. I am not sure I understand. Let me phrase it a different way.

How is it irrational to strike us in a "bolt out of the blue," wiping out presumably all of our land-based forces and half our subs, or whatever the non-alert sub figure is, and whatever the percentage of planes that would be knocked out—if that is irrational, tell me again how it would be rational if all those forces are on alert, including your new rail-mobile?

Dr. IKLE. It is the alternatives that the Soviet high command would look at. And if they see two alternatives—one, being attacked by these alerted U.S. forces that you just described and waiting to be attacked; and the other, striking first—there is that risk that they may feel and calculate that striking first would be less disastrous than waiting first to be attacked.

And that, of course as you know, is the traditional idea of the problem of strategic stability.

Senator LEVIN. Is that not an argument for better conventional forces, rather than first strike ICBMs?

Dr. IKLE. For starters, yes. You want good conventional forces.

Senator LEVIN. My time is up. If the record could be kept open, I would like to ask additional questions.

Senator EXON. The record will be kept open.

Senator Gore.

Senator GORE. Thank you, Mr. Chairman.

ICBM MODERNIZATION

I find Dr. Ikle's comments fascinating. I find it unusual, first of all, that Dr. Ikle would again take issue with the administration's official, stated position on ICBM modernization, and ask to testify in a way that really is calculated to undermine the effort to reach some consensus with respect to ICBM modernization.

What I find most fascinating is the comments just made in response to Senator Levin's questions. You have pointed out that the Soviet Union, during an escalating crisis in Europe, might perceive an intention by the United States to launch a nuclear strike first against the Soviet Union, and that in the midst of such a crisis, when they perceived such a U.S. and/or allied intention, that they would then preemptively attack before the United States could strike.

Now, let us pursue that for a moment, because I happen to agree with those who, along with Senator Levin, feel that the "bolt out of the blue" scenario has been overemphasized, that it in some respects is a red herring. What we are talking about is crisis-management.

Let us postulate the kind of crisis that you have just discussed. The Soviet Union is watching during the midst of this crisis for some indication that the United States might launch nuclear missiles first. All right? The Soviets are watching and waiting.

And all of a sudden the MX is rolled out of the garrison and put on the rails. And during that first 2 or 3 hours, they can knock it all out with a relatively small number of SS–18 warheads, whereas if they wait for 3 hours or much likely longer than that they would not be able to knock it out with their SS–18 force.

Would that constitute the kind of signal that you are postulating in your statement that would cause the Soviets to preemptively use nuclear weapons first?

Dr. IKLE. Let me first take issue with your first point about—that you were puzzled that I am taking issue——

Senator GORE. Well, I am not really puzzled. I have come to expect it. I am not really puzzled.

SMALL ICBM

Dr. IKLE. Then your expectations are not disappointed. I am not taking issue with the administration's position. It is in the President's budget, as I explained, to have the small ICBM.

We have followed the mandate of Congress and have analyzed the costs and technical ways of deploying the small ICBM and going forward with it. We have it in the budget, and we also have the Peacekeeper.

Senator GORE. But you are coming here before this committee and you are saying: "Read my lips, cut the money out for Midgetman." That is what you are saying.

Dr. IKLE. No, Senator, I am not practicing any cover-up. I am giving you the facts, and I think the Senators are entitled to have the facts.

Senator GORE. It is clear, your message is clear.

Dr. IKLE. Then the message then maybe speaks from the costs, and I think you are entitled to the costs.

Senator GORE. And it is contrary to the President's——

Dr. IKLE. No, it is not contrary. It is part of the President's open presentation of costs.

But your other point is——

Senator GORE. Let me just say, the President's recommendation is that we begin development of the Midgetman missile as part of an integrated package. You do not really think that we ought to do that, do you?

Dr. IKLE. The President has been following——

Senator GORE. Do you think that we ought to do that, Dr. Ikle?

Dr. IKLE. I think——

Senator THURMOND. Let him answer the question.

Senator GORE. I am trying to get an answer——

Senator THURMOND. He has got a right to answer it——

Senator GORE [continuing]. Senator Thurmond.

Senator THURMOND [continuing]. Without interruption.

Senator GORE. I am asking him to answer the question, Senator Thurmond. Thank you.

Dr. IKLE. I think the Congress ought to examine, in light of the data and facts which the administration is now able to present, whether it wants to change its mandate or whether the administration should continue the congressional mandate of going ahead with both of these systems.

Senator GORE. Do you think we ought to do it?

Dr. IKLE. I think the administration ought to follow the congressional mandate.

Senator GORE. Do you think we ought to do it, Dr. Ikle?

Dr. IKLE. As long as it is the law. I think the Congress——

Senator GORE. Do you think we ought to do it?

Dr. IKLE. If you are asking my advice to you as a Senator from me as a person who has examined the data, I think it is not necessary to go ahead with the small ICBM. The cost does not justify.

Senator GORE. All right. I just wanted to have that on the record. And I appreciate Senator Thurmond's discomfort with my procedure, and I apologize if I pressed you too hard.

But I wanted him to state candidly for the record that his view on this is different from the view expressed by the President.

Senator THURMOND. Mr. Chairman, I just want to make this point clear. You have a right to press him all you can, but once you ask your question he has the right to complete his answer without your interruption.

Senator GORE. I understand that, and I appreciate my senior colleague's advice on that point. My frustration was based on the fact that he was not answering the question that was asked.

But can we move on now, because the point that I was making about the destabilizing effect of rolling—here you have this crisis in Europe and, according to your scenario, the Soviets are watching for some sign that the United States is going to strike first, as our doctrine calls for us to contemplate.

And then in the midst of that crisis, we roll out the MX onto the rail lines and present the Soviets with a message: You have got 3 hours; you can kill it easily and quickly if you strike first during this 3-hour period; but if you wait, then your opportunity to get these warheads is now gone.

Is that the kind of signal that causes them to strike first?

Dr. IKLE. In reality, the timing would be different. Our doctrine, of course, does not call for using nuclear weapons first in response to some initial warnings of Soviet mobilization for a conventional attack. But as soon as we receive these warnings, that is when we should disperse the rail-mobile Peacekeeper.

As we move our forces to Europe, as we break out and disperse other assets, break out POMCUS in Europe, it is in that period. And the NATO doctrine envisages the possibility of a nuclear weapons first use only after nuclear war has already run its course and can no longer be stopped.

Senator LEVIN. Forgive the interruption. You said only after a nuclear war has run its course?

Dr. IKLE. I misspoke. Only after a conventional war has run its course. So it would be several days or weeks, whatever, after the conventional has taken place, long after the rail-mobile MX had been dispersed.

It is a question of first use.

Senator GORE. My time on this round has expired, but let me say in conclusion that I do not accept your assertions about the precise timing of these events. I do not think you can predict that at all. I think that as a crisis of the kind you speculate on develops, you cannot predict what is going to happen in the minds of those decision makers.

And there would be a profoundly destabilizing effect which would flow from a decision by the United States to roll these missiles out of the garrison and start putting them out onto the commercial rail network.

I will come back on the second round to that.

Dr. IKLE. Would you consider it destabilizing also if the small missile is moved out?

Senator GORE. Not at all, because first of all it only requires tactical warning, and it would not need to be dispersed during such circumstances. Within 15 minutes it would require more than the entire Soviet ICBM force to destroy it.

So it does not need to be dispersed in a destabilizing manner at the height of a crisis.

Dr. IKLE. Would it not be the prudent thing to move it out before the tactical warning, if you have strategic warning?

Senator GORE. I think that military planners would probably advise the President to do that. But as a political decision maker, the President under such circumstances would want the option of not taking what might be seen as a destabilizing action, and he would have the freedom to do that with Midgetman, because it only requires a 15-minute tactical warning.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator.

Let me start the second round. We will go 3 minutes on the second round, so we can wind this down as quickly as we can.,

MIDGETMAN TESTING AND DEVELOPMENT

Who in the Department of Defense endorses the idea of proceeding with the Midgetman testing and development?

Dr. IKLE. The testing and development of the Midgetman is mandated by law, and we all endorse that we should follow the law. This is the President's position.

Senator EXON. That is not what you and other people have told me off the record.

Dr. IKLE. I doubt we have told you off the record that we want to violate the law, Senator. You may have been pressing off the record the question that Senator Gore quite rightly pressed on the record here. If you were to make the decision that Congress has to make, which way would you go?

In that case, I said I would not invest in a small ICBM. But this is a decision for Congress to make.

Senator EXON. Is there anyone in the Department of Defense that agrees with the direction that you received from the Congress to proceed with the research and development of Midgetman?

Dr. IKLE. I would say up to a point I find it was a valuable directive. It is important to have looked at the small ICBM.

I remember in 1973 when I was director of the Arms Control Agency I urged the Pentagon to design a smaller ICBM than the MX so as to make it more mobile. We have now a very small design mandated by Congress, and it was worth looking at what the costs would be, how it could be done, and to go a certain step in development so that we know what this option looks like.

Senator EXON. I will try again, Dr. Ikle. I will try to make my question very precise. If you cannot answer the question, I will understand it.

Had not the Congress mandated, suggested, threatened, directed the Midgetman to be built, would there be anybody in the Depart-

ment of Defense today who would be subscribing to the recommendation that came over here in the President's defense budget?

Dr. IKLE. Probably not. The development probably would not have been carried on as far. It would have been a more preliminary research project.

Did I answer your question

Senator EXON. Yes, I think finally you answered my question. Maybe that is the only way you could answer it. I am not criticizing you. I am just trying to get to the facts here.

FUNDING THE SDI PROGRAM

I take it that what you are saying here today, if we would cancel the Midgetman you would want all or most of the savings to go into the SDI program? Do I read you correctly?

Dr. IKLE. No, I did not put that in my remarks, I do not think so.

Senator EXON. Do you believe that would be a good idea?

Dr. IKLE. It depends at what level SDI is funded. I think the SDI program should be funded at the level we propose.

Senator EXON. I have taken it that the Air Force is not too enthused about Midgetman, either. And yet, I saw a newspaper quote the other day that, when this Senator was quoted as questioning whether or not we could afford the Midgetman, some unnamed Air Force official said that: Well, Senator Exon was probably premature in his statement.

What I am saying, Dr. Ikle, is there may be some premature decisions that are going to have to be made by this committee. Whether we have the courage to make them or not, I do not know. But I think that some decision should be made and that—let me ask this question.

As far as you know, is there anyone in the Air Force up to the Chief of the Air Force who would be subscribing to expend the $2 billion that the President has recommended for the development of a Midgetman were it not mandated, directed, or threatened by the Congress in direction to the administration?

Dr. IKLE. Well, I cannot speak for all of the officers in the Air Force.

Senator EXON. You have a general relationship.

Dr. IKLE. My general impression is that, given where we are, the Air Force analysts and officers who have looked at this question find the rail-mobile deployment of the Peacekeeper a more efficient way of achieving the offensive capability that we need, and they would prefer it.

Senator EXON. And they would want the Midgetman on top of that?

Dr. IKLE. If you get it for free, it is a good missile.

Senator EXON. If you get it for free?

Senator GORE. Would the chairman yield?

Senator EXON. I am going to yield now to Senator Thurmond.

Dr. IKLE. The difficulty here comes for various people. It depends on where they stand in the budgeting process and so on. If you look at the Air Force budget and you envisage that you would get the additional money to buy both missiles, then indeed from that point of view you are better off.

Now, you have to ask where that money comes from. So there is a question of a tradeoff there.

Senator EXON. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

Dr. Ikle, as I understand it, what you are really saying is that Congress has mandated this small ICBM and therefore the law will be carried out by the administration and the Air Force.

Now, if Congress had not mandated it, as I understand it, the administration feels and probably the Air Force feels that it would have been better to have just gone with the Peacekeeper. It would be three or four times cheaper. Is that right?

Dr. IKLE. At this time that is the way it looks. It is three or four times cheaper. But we would not have had this knowledge about the relative costs if we had not made the studies.

So I would say up to a certain point it is valuable, as I mentioned earlier, to have conducted studies about the small missile.

Senator THURMOND. Now, of course, if you had plenty of money and did not have budget constraints, you could go forward with both the Peacekeeper and with the small ICBM. But under the budget restraints, if we have to cut something, would it be your opinion that we eliminate the small ICBM and keep the Peacekeeper?

Dr. IKLE. That is right, Senator, it is my personal opinion.

Senator THURMOND. And Dr. Ikle, with the de-emphasis on planning for "bolt out of the blue" with respect to ICBM modernization, are we likely to see a similar de-emphasis on the percentage of bomber and submarine forces that we keep on peacetime alert?

Dr. IKLE. I would not think so. Let me—this gives me an opportunity, Senator, maybe to correct what may have been misconstrued in my remarks about the "bolt out of the blue." We cannot totally neglect the possibility that, if we are negligent about our forces, at some point military planners, enemy military planners, might think they could indeed mount such a disarming strike.

The reason the "bolt out of the blue" is and shall remain an irrational option is only that we maintain on alert submarine forces, bomber forces. We have to do certain things in order to keep that option an irrational option.

Senator THURMOND. Thank you, Mr. Chairman

Senator LEVIN. Thank you, Senator Thurmond.

First, is your testimony here today reflective of the position of the administration, or are you deviating from the administration's policy in anything that you have said?

Dr. IKLE. I am not aware that I am deviating from the administration's policy in anything, any of my testimony. But it is not the whole story, because I kept it very short. I just made some highlights.

Senator LEVIN. Is there anything that you testified to today, any advice you have given us, any recommendations you have made, that would not be supported fully by the administration?

Dr. IKLE. Not to my knowledge.

Senator LEVIN. A few minutes ago you said this was your personal opinion, for instance.

Dr. IKLE. Well, it was qualified as that.

Senator LEVIN. Was that also the position of the administration, for instance, that they would prefer MX to Midgetman?

Dr. IKLE. If you are constrained in the budget, I think it follows from the figures that the more expensive deployment would be second priority and may not make it.

Senator LEVIN. So is it fair to say that that is the administration's position, too, or do you not know?

Dr. IKLE. Well, we have to see. I think it partly depends upon the overall budgetary process. If there is enough money, the small missile—do not get me wrong—can make a contribution. It is a technically feasible missile, it is survivable. In that sense it is a good missile. It is a question of cost.

MOBILE MODE FOR MX

Senator LEVIN. Now, Congress also mandated that we put the MX in a mobile mode. Is that the only reason you are recommending that? To put it another way, if it were not for that congressional mandate would you not be recommending that we build 50 MX more in fixed silos, rather than a mobile mode?

Dr. IKLE. I do not think there is an administration position on this since that is a hypothetical question. But if you are asking me, I feel it is very important to have a survivable MX deployment and I therefore feel that a search for a survivable way of deploying the MX was a very valuable search, and the congressional mandate helped on that.

Senator LEVIN. If it were not for the congressional mandate, would you be personally recommending we go with this rail-mobile or would you be recommending that we put an additional 50 MX in fixed silos?

Dr. IKLE. I would recommend the rail-mobile. I would recommend the rail-mobile

Senator LEVIN. Even without the mandate?

Dr. IKLE. Yes, without its being legislated.

Senator LEVIN. Senator Gore.

Senator GORE. Thank you very much, Mr. Chairman.

First of all, before I go to my first question, I am sure it was inadvertent, but I feel that you have misrepresented the position of the Air Force when you say that they would only support—that they only really support Midgetman if they can get it for free.

I know for a fact that at least part of the Air Force supports Midgetman. The ballistic missile office is genuine and sincere in its support for Midgetman and has not participated in the kind of exercise that you are engaged in here today.

Moreover, the Air Force has expressed disagreement as recently as a few days ago with your statement that there is no unique capability for the small ICBM warhead. We have long had as part of our doctrine a specialized role for single warhead missiles, and with the imminent degradation of the current Minuteman force, the Air Force keenly desires a follow-on, single-warhead system for doctrinal reasons, as well as for survivability.

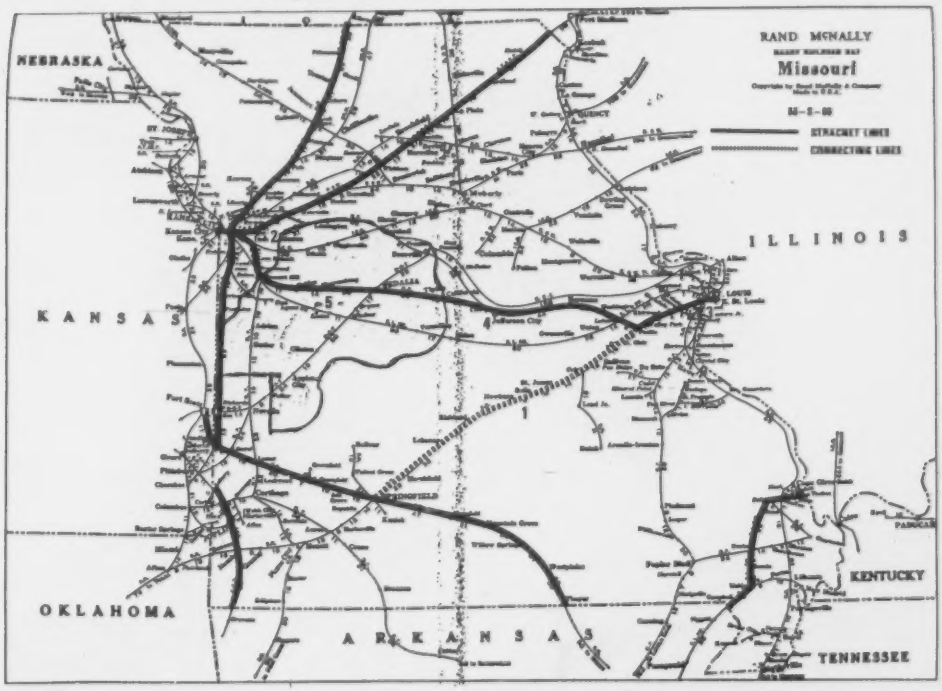
Let me ask you a question about your conclusion, your use of the word "now." You say that Congress should now decide between these two systems. And you would take the position that the ques-

tions are all essentially answered with respect to rail-garrison MX and that, unlike the other witnesses who testified here from the administration, we do not really need to answer any more questions about it before we make the decision to choose it over Midgetman.

You give the impression that those questions are all answered, and yet we have had—I have made some points here in these hearings, which you may not be aware of, about the nature of these rail lines. Much discussion is given to the number of hours that the MX could travel on these rail lines.

I would say, first of all, that any system that can be destroyed within 1 hour by 30 SS–18s is not a survivable system and not a stabilizing system. But beyond that, let us assume—let us look at this 3-hour figure. In 3 hours, the system could go from Little Rock to Memphis or from Little Rock to New Orleans.

But in order to assume the 3-hour dispersal time, you have to assume that downtown New Orleans is part of the sanctuary for the MX rail-garrison missile. Moreover, I have got new data in the form of maps, one of which I will provide as an illustration for the record, from this unclassified document, entitled "Civil Rail Lines Important to National Defense."



In other words, if we are in the midst of the kind of crisis in Europe that you talk about in your testimony, we are going to be mobilizing. We are going to have a lot of rail activity in and around military bases as part of our mobilization.

Interestingly enough, these maps demonstrate that the same rail lines that are vital to be used during military mobilization are the ones that the MX is going to be running on from Little Rock to New Orleans. So we have a choice between mobilizing and clogging

up those rail lines on the one hand or not mobilizing and keeping them free so that the train can go from Little Rock to New Orleans and hide in the French Quarter before the SS–18s get there.

We have not answered any questions about the quality of the track to carry the loads, as heavy as these loads would be, at the speeds that are assumed as part of this plan. There has been no calculation made for the fact that in the case of several of the proposed sites, the first hour's worth of track runs through Minuteman bases which, as linear targets, are already part of the Soviet target set, which would include an effort to saturate those Minuteman bases.

There are a number of other questions that have not been answered. And for you to take the position that now is the time—and I am quoting from your statement here—that Congress should decide now between these two systems, I think is irresponsible and inaccurate and out of sync with the administration's official position.

Now, I have another question if I have time, Mr. Chairman.

Senator LEVIN. You are out of time. There are all these other members here that want to ask questions. We have to go to them first. But I would be happy to yield to you the first 2 minutes on my third round.

Senator GORE. I know that we have to follow the procedure here.

Now, you say in your statement on verification that, even with the most far-reaching verification arrangements, that the Soviet Union could covertly deploy as much as 200 percent over the allowed limit. All right. Now, the administration's official position right now is that there could be, under a treaty, 100 SS–20 warheads deployed somewhere in Asia, along with far-reaching verification measures.

Is it your testimony here today, Dr. Ikle, that the Soviet Union is also going to be able to deploy covertly 300 SS–20 warheads, if we sign the agreement that our negotiating team is about to present to the President?

Dr. IKLE. Let me answer your first question first. The question on railroads is an excellent question and you are absolutely right. You want to have more detailed answers on these aspects.

My word "now" does not refer to this afternoon.

Senator GORE. Does it refer to this fiscal year?

Dr. IKLE. I would think in this fiscal year we should be able in the Pentagon to give you the detailed answers on these questions.

Senator GORE. Before you get the R&D money to do it?

Dr. IKLE. I want to grant you the validity of your questions and the importance of looking at whether there is a conflict in the use of railroads, whether there are alternative railroads, how these things could be sited. So that these are really important points and they ought to be factored in the decision that Congress has to make.

Senator EXON. We will now go back to Senator Levin.

Senator GORE. Mr. Chairman, I had another question which I have already asked, which I think that he ought to have a chance to answer, having to do with——

Senator EXON. I will give you that consideration, and then I am going to bang the gavel.

Answer the question quickly or tell him you cannot.

Dr. IKLE. Very quickly, I was referring to strategic missiles, not INF. So it was not directly targeted on the INF. But there is a certain risk of comparable magnitude associated with the INF missiles.

What I referred to in the statement is unambiguous evidence. Of course, there is always the question of having grey evidence, less certain evidence, which we would find difficult to act on, as you have noticed in the many statements by the President about other violations. And we have engaged in long debates whether these violations actually took place or not, because very often the evidence is not that black and white.

Senator EXON. Senator Levin, one question.

Senator LEVIN. Thank you, Mr. Chairman.

VERIFYING MOBILE SYSTEMS

You testified that mobile systems, if permitted under the numerical limits, are extraordinarily difficult to verify. Is there in your opinion any difference in the difficulty as between the Midgetman and the rail-garrison MX? Is either one of them more or less difficult to verify?

Dr. IKLE. I do not agree that the Soviet Union would have the same difficulties in the United States, because they have other sources of verification. So the problems are for us in verifying Soviet missiles, and there I would say the larger the missile probably, by and large, the easier it is to verify.

Senator LEVIN. Thank you. I reserve any further questions for the record.

[Questions for the hearing record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR DAN QUAYLE

STRATEGIC POLICY AND ARMS CONTROL ISSUES

Senator QUAYLE. We have heard a great deal about the emerging conventional ballistic missile threat posed by the newer SS-21s, SS-22s, and SS-23s. Wouldn't one of the Soviets' key targets for these conventional systems in the future be NATO's key nuclear assets such as INF? How difficult would it be for the Soviets to target NATO's INF with improved versions of the SS-21, 22, 23 given that our GLCM's are housed in hardened shelters and that both the GLCMs and the PIIs are mobile?

Dr. IKLE. As a result of current and projected qualitative and quantitative gains, Soviet shorter-range ballistic missiles (SRBMs) armed with improved conventional warheads would pose a direct threat to many "soft" NATO targets, such as troop formations, surface-to-air and surface-to-surface missile launcher positions (such as GLCM, PII, and LANCE), C^3 systems, and NATO's logistical complex. All modernized versions of Soviet SRBMs have substantially improved accuracy over their predecessors and, in most cases, greater range.

Modern Soviet SRBMs could target GLCM and PII fixed peacetime locations. These assets, like other NATO nuclear assets, would be key targets for the Soviets. However, once deployed to dispersed field locations, the survivability of both the GLCM and PII would be increased dramatically.

DIFFICULTY OF VERIFYING

Senator QUAYLE. Could you please compare the relative ease or difficulty of verifying the number and location of INF systems as compared to shorter-range ballistic missiles.

Dr. IKLE. In general, the smaller the systems—particularly if they are mobile—the more difficult it will be to locate them and thus to confirm that the Soviets have no

more than the number permitted by a treaty and that they are not at locations other than those that have been declared. We expect that verifying the numbers and locations of both longer-range and shorter-range INF missiles will pose difficult problems, because of the nature of these systems (relatively small and mobile) and the possibility of Soviet cheating, as evidenced by past Soviet violations of their arms control commitments. Because of this, we have proposed extensive verification measures to deter Soviet cheating and better monitor Soviet activities relevant to determining Soviet compliance or non-compliance with the INF Treaty limits and provisions. These measures include:

Specification of areas and facilities where treaty-limited systems must be located and a prohibition against having them elsewhere.

Reciprocal exchange of a specified, comprehensive set of data related to treaty-limited systems and their support facilities and equipment.

Periodic reciprocal updating of this data.

Specialized procedures for destruction, dismantlement, and conversion of longer-range INF systems including on-site inspection.

On-site inspection/monitoring initially when the treaty goes into effect and subsequently to ensure compliance with the treaty limitations.

STRATEGIC POLICY AND ARMS CONTROL ISSUES

Senator QUAYLE. Wouldn't it be in the interest of the West if we could secure a true zero/zero ban not only on Intermediate range missiles but on shorter-range ballistic missiles as well leaving us with the right to develop conventional and dual-use cruise missiles?

Dr. IKLE. The United States and NATO have long held the objective of the complete elimination of LRINF missiles. Supported by the Alliance, the United States has consistently asserted—publicly and to the Soviets in Geneva—that appropriate constraints must be applied to SRINF concurrently with reductions in LRINF systems. To do otherwise would undercut the effectiveness and viability of any INF treaty.

We are, of course, continuing to examine U.S. and NATO SRINF requirements in the context of zero-zero LRINF missiles in Europe. In this examination, we are assessing our overall nuclear and conventional force requirements and capabilities. U.S. and NATO SRINF requirements—either a zero/zero ban on specific SRINF missile systems or a much reduced equal overall SRINF ceiling—must be based on the political and military role these deterrent systems must fulfill.

Senator EXON. Senator Levin, Senator Gore, thank you for being here most of the afternoon. I think it has been an interesting hearing, both the closed and the open part.

Dr. Ikle, we appreciate very much your coming over for the testimony. We are adjourned.

[Whereupon, at 5:27 p.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, MARCH 12, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

CAPABILITIES OF U.S. AND SOVIET STRATEGIC FORCES

The subcommittee met in executive session, pursuant to notice, at 10:04 a.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Gore, Warner, Thurmond, Quayle and Wilson.

Staff present: Arnold L. Punaro, staff director; Carl M. Smith, staff director for the minority; Robert F. Bott, William E. Hoehn, Jr., Ronald P. Kelly, professional staff members; and Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Leon Fuerth, assistant to Senator Gore; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order. We are in closed session this morning.

The subcommittee meets this morning for the eighth time in its planned series of hearings. The subcommittee is delighted to welcome once again General Chain, our great leader out at the Strategic Air Command, who has been before this committee previously and will be back again often. I just wanted to say in opening, General Chain, that this committee has a great deal of respect for you and the tremendous job that you are doing out there, and therefore we think that this briefing that you are going to give us in closed session is going to be very helpful to us. We will try to move along in a speedy fashion.

Some of the members of the subcommittee will recall that General Ellis, when he was CINCSAC, annually presented to this committee the results of the strategic forces net assessment. That net assessment looked at the results of several scenarios of strategic

conflict between the United States and the Soviet Union. In addition to demonstrating the enormous destructive capacity of the strategic forces of both countries, this analysis allowed the Members to see how proposed U.S. strategic modernization efforts affected the outcomes of the calculations over a period of time.

The committee found this to be very helpful and so Senator Nunn and I prevailed on General Chain, on very short notice, I must add, to resurrect that capability at SAC. Although he has had less than a month since we informally requested the briefing and only a couple of weeks since we sent him a letter outlining what we had in mind, he has arranged to bring us today what information he could.

I mention this to the members so that they can appreciate how much work SAC has had to do to prepare for our briefing this morning. But I also would like to say to General Chain that, effective as of right now, you have just been given a whole year's warning about next year's briefing to our subcommittee. We will expect a superlative effort next year.

Let me include a copy of our letter to General Chain in the record at this point.

[The letter referred to follows:]

U.S. SENATE,
COMMITTEE ON ARMED SERVICES,
Washington, DC, February 26, 1987.

General JOHN T. CHAIN, Jr.,
Commander in Chief, Strategic Air Command, Offutt AFB, NE.

DEAR GENERAL CHAIN:

As we discussed individually with you during your recent trip to Washington, we want to return to the tradition of the CINCSAC briefing the Committee on the status of U.S. nuclear deterrence, under a variety of scenarios and assumptions. This is consistent with the request we are making to each CINC; we have had comparable net assessments and testimony from all of the other major CINCs who have appeared to date.

As we discussed, we would like you to be prepared to present the results of a strategic attack by the Soviet Union on U.S. nuclear forces, for both generated-alert and day-to-day conditions, measured in terms of both surviving weapons and counter-military potential on both sides. We would further request that the same measures be provided after a U.S. retaliation against Soviet residual forces. The results should be derived both for current forces, and for those forces projected to be available at the end of the FYDP period.

The Strategic Forces and Nuclear Deterrence Subcommittee plans to hold a hearing on the morning of Thursday, March 12, at which time we would plan to set aside 1½ hours for your presentation and for questions. We will invite all members of the Committee to be present.

We recognize that the CINCSAC's net assessment was discontinued by SAC after General Ellis' tenure, and that it may not be possible to provide all of the requested data and the effects of alternative assumptions by the time requested. We hope you can present as much as possible. But it is our intent to again institutionalize this process, and we would expect next year's presentation to deal with this in a comprehensive fashion. Because time is short, we would be satisfied with a briefing this year, with no requirement for a written statement. We would also welcome your views on another subject of interest to the Committee—the adequacy and reliability of strategic warning, especially in the context of the proposed rail-garrison MX program.

We trust it will be possible for you to appear as requested; the point of contact for your staff is Dr. Bill Hoehn (202) 224-9343, who will be glad to be of assistance.

Sincerely,

SAM NUNN, *Chairman.*

Senator EXON. Before I turn to General Chain for the briefing, let me call upon the ranking minority member, Senator Thurmond,

for any comments he would like to make at this time. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

I want to congratulate you on the excellent work you are doing as chairman of the subcommittee. Mr. Chairman, I want to join you in welcoming back John Chain to the subcommittee.

Our focus this morning will be considerably broader than the B-1B problems that were the subject of our last meeting with General Chain. Over the years this subcommittee has benefitted from analyses of the strategic balance that were produced by the Strategic Air Command. These presentations provided insights into our policies and those we ascribe to the Soviet Union, as well as the relative ability of the two sides to carry out those policies.

I congratulate you, Mr. Chairman, for scheduling this hearing and your intent to provide such important information. Such analysis seems hard to come by these days. Posture statements, to the extent they address assessments at all, concentrate on static balance measures and fall far short of providing a useful net assessment.

So, General Chain, we look forward to your testimony this morning and we have high expectations that your presentation will fill what has become an information gap in the consideration of our overall strategic force posture. In addition, General Chain, a number of issues have been raised in the course of recent hearings, particularly with regard to the ICBM force. I look forward to your responses to questions on these issues because I think that the views of the operational commander are very important and very relevant to our deliberations on this year's budget request.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond.

Chairman Nunn has just joined us. Welcome. Any opening statement you care to make?

Chairman NUNN. Mr. Chairman, I have got the same malady President Reagan does. I have laryngitis this morning.

Senator EXON. Stroke your throat when you say that.

Chairman NUNN. I am in a listening mode. I thank General Chain for what he is doing. The net assessment will help us both now and for what you are able to do in the future.

Senator EXON. Thank you.

Would you proceed now, General Chain?

STATEMENT OF GEN. JOHN T. CHAIN, USAF, COMMANDER-IN-CHIEF, STRATEGIC AIR COMMAND

General CHAIN. Thank you, Mr. Chairman, Senator Thurmond, Senator Nunn. I am pleased to have the opportunity to be with you again as you requested.

Today I would like to begin with a superlative briefing this year that assesses our Nation's deterrent capability. This assessment, like previous assessments, is developed from an analysis of current and projected Soviet and U.S. target bases, force structures, force capabilities, and damage calculus within the context of national nuclear guidance.

Force structure capability analysis is a continuing process at SAC. In your letter of invitation you referenced General Ellis' previous testimonies. We used essentially the same analytical and modeling techniques, updated to reflect changes in guidance and model sophistication. My objective is to provide you information which will help you make the hard financial choices.

With your permission, I will now give the presentation.

Senator EXON. Please proceed.

General CHAIN. I am here to talk to you, obviously, about deterrent forces.

WHAT WE'LL TALK ABOUT

Objectives and threat.
Force comparisons.
Deterrent tasks.
What it takes.
The analysis.

To do that, this is the outline that I am going to follow. I am not going to give you an in-depth briefing on the threat. You already know about that. I will have a couple of charts to remind you of the thrust of it, a couple of force comparisons charts which are just static measures, again to provide the background from which we can talk.

I will tell you a little bit about our task to provide this deterrent force, tell you what I think we need to be able to carry that out, and then provide the analysis of how we are doing.

THE MILITARY REQUIREMENT

SOVIET MILITARY THREAT

Now obviously we have to start with the Soviet military threat, and then our elected officials give me and the military our national security objectives. The appointed officials give us our defense guidance. The JCS comes up with the military strategy. Then as the operator in the field, as a commander, I come up with the military tasks to carry that out. And from that logic train we get to the military requirements.

I am going to give you two charts on the threat. In a macro sense here is what Secretary Weinberger said recently, and I will just let you read that.

[Pause.]

THREAT

Soviet force development reflects a set of objectives for strategic and related forces that is far more ambitious than our own. The Soviet attempt . . . to erode the deterrent character of U.S. nuclear forces. By modernizing their offensive forces in ways that threaten our deterrent capabilities, . . . the Soviets are attempting to make our strategic offensive forces less secure against attack and less effective in response.

We recognize evidence of Moscow's efforts to build a nuclear warfighting machine, reflecting a Soviet belief that nuclear war may, under certain conditions be fought and won.

And, to show you that we are not parochial I will show you what some of you have said about the threat recently.

[Pause.]

THREAT

Americans today face three urgent threats to our freedom and long-term security. The first is the continuing Soviet drive for military supremacy.

Over the past two decades, the Soviets have engaged in an extensive and sustained military buildup.

Their deployment of more advanced and menacing strategic nuclear forces during the last 20 years is well-established.

Chairman NUNN. Does it take five of us to equal Secretary Weinberger?

General CHAIN. No, sir.

CHANGING NATURE OF SOVIET FORCES

Capabilities:

Growing number of prompt, accurate offensive systems.

Steadily increasing hardness of nuclear forces, command control, and leadership facilities.

Increasing emphasis on redundancy, dispersion, and mobility of forces and command control assets.

Continuing modernization and expansion of an extensive strategic defensive system.

End result:

Forces more suited to warwinning strategy.

I wanted you to know we watch you and hear what you say to us also.

[Deleted.] They are increasing their hardness, which provides complications to me as the SAC commander. They continue to modernize and obviously they continue to concentrate on mobility.

But the bad part of it is it seems to go toward a warwinning strategy, which they write about.

SOVIET PERCEPTIONS

Are shaped by: The overall military balance. [Deleted.]

Now as far as looking from the Soviet side, what does it take to deter them. Obviously they are interested in the military balance, whether they have enough force to deter us, and whether we have enough force to deter them. And in that deterrence, as they look at us, they look at these things.

Can we do these things? These are the things that they hold most dear, and I will come back to these in very specific addressal in a few moments [deleted].

NATIONAL SECURITY OBJECTIVES

Our national objective, as given to me [deleted] fails I am supposed to be able to do these things [deleted] and during peacetime and day-to-day to make sure that they do not have enough force that they could intimidate or coerce ourselves or our allies.

THE OBJECTIVE—TO DETER

To ensure that no Soviet leaders could ever believe they could gain from attacking the United States or our allies.

The bottom line of the mission obviously is that no Soviet planner can go to a Soviet leader and say I figured out a way we can successfully attack the United States and get away with it, and if I can see that never happens then I have accomplished my mission.

FORCE COMPARISONS

Now I am going to give you a couple of charts on static force measurements, and they are just background to what I will be talking about in a few minutes. You know this data.

You know that this is the relative size of the forces today. And this is the relative size of the forces in 1992.

THE STRATEGIC BALANCE TOTAL ACTIVE INVENTORY

[Deleted.]

As we turn this into warheads, the attack capability, this is the relative size and I draw your attention to three areas. One is the throw weight. This is the amount of destructive power that they can throw against the United States versus the amount of destructive power that we can throw against them [deleted].

Senator EXON. General, could I interrupt you for just a brief question right here? We see these kinds of charts all the time, and I think they are very helpful. But those charts do not accurately measure or reflect, do they, the likely outcome of a conflict where both sides would be adequately warned and prepared? What I am talking about is that that chart does not reflect the true capability of who would win and who would lose?

General CHAIN. This is just raw data, Mr. Chairman. And at the end of this presentation I am going to get into the analysis of who does what to whom, which is the reason I am here, but I cannot get there without making sure that we are all on the same song sheet. This is just background, if you would, because I owe it to you to see that this is presented before I get to the bottom line.

THE STRATEGIC BALANCE GENERATED WARHEAD COMPARISON

[Deleted.]

With that in the background, what are our tasks? Our tasks are relatively simple. We have got to defeat the Soviets' war aims, and to do that we have got to be able to do this: complicate their war planners' thoughts beyond the time of reasonable risk. I have to be able to increase their uncertainty about their capability to do anything against the United States, and I have to raise the price of their attack beyond reasonable limits. And if we can do that, we can deter.

DETERRENT TASKS

So what does it take to do that? I have got to be able to do these things, and I am going to go into each of these areas in detail.

OUR TASKS DENYING SOVIET WAR AIMS

[Deleted.]

Now the damage criteria, as I gave you the logic train in the beginning, when it gets from the national objectives to the defense objectives to the military strategy, when the Joint Chiefs meet they give me these categories. The categories came from our elected officials. They said these are the targets we are supposed to be able to hold at risk.

[Deleted] and I will cover these in detail about these in just a moment.

WHAT IT TAKES

In the aggregate here is where we are today, and I will be explaining this in just a minute. We have a target base in the Soviet Union that is represented by this bar, [deleted.] My capability against that target base today is [deleted]. And I will explain that to you.

Chairman NUNN. General, is that after absorbing a first strike, or is it on first strike?

General CHAIN. [Deleted.] Again, Senator Nunn, I am going to be walking through how that all comes to pass in just a minute, and I prefer to defer your question and then come back, if you would like.

HOW TO MAKE COST AND RISK UNACCEPTABLE

[Deleted.]

The bar I just gave you included over [deleted]. These are precise numbers. The Chiefs have told me I have to be able to hit [deleted] targets, and I have to be able to hit those with an [deleted]. I have to be able to hit [deleted] and I have to be able to hit those [deleted].

I have to be able to hit [deleted] other military targets, which would be [deleted] and I have to be able to [deleted] percent. [Deleted] and I have to be able to destroy those at [deleted]. Things like [deleted] would fall into this category.

So that is what I have been told that I have got to be able to do.

DAMAGE CRITERIA—THE BASIS FOR CONVINCING DETERRENCE

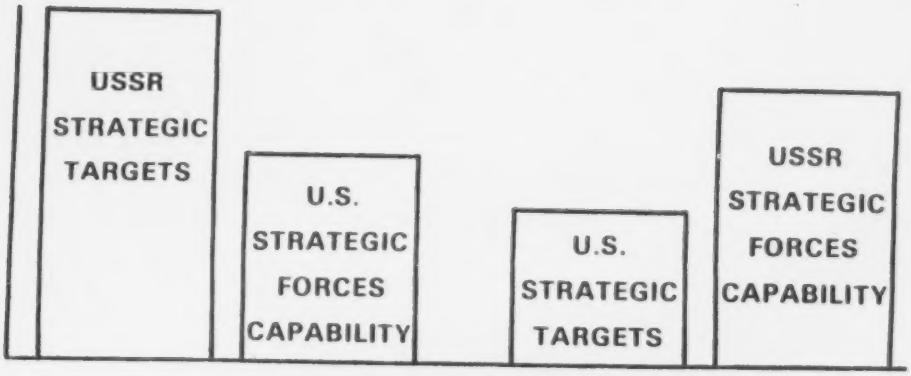
[Deleted.]

Now I am going to tell you how I can do against that. I remind you that the way that we get to the [deleted].

Through this logic train we then come up with what I can do against that [deleted] responsibility we have.

WHAT IT TAKES: NUCLEAR FORCES

WHERE WE ARE TODAY



THE TASK/CAPABILITY IMBALANCE

Now I am going to walk you through four scenarios and I am going to take those four scenarios from a number of different year groups, ranging from 1983 up to 1996.

The base scenario that I am going to walk you through is a [deleted]. You may disagree with it, and that is why we are going to go through four scenarios. But the one that I feel, as CINCSAC, [deleted] is that there will be tensions, there will be crisis, there will be a war of some type somewhere in the world, and that both the United States and Soviets will have generated their nuclear forces.

[Deleted.] All the submarines that have been generated will have gone out to sea, and the submarines that are left in port—[deleted]. So there are the factors, and I will leave this chart up for just a minute to remind you what they are.

Current forces and projected forces on both sides that we are going against, [deleted].

THE ANALYSIS

Now into the analysis. I am going to start with 1983. [Deleted.]

Now because of your support and your efforts to get us the offensive avionics systems in the B–52, the air-launched cruise missile on the B–52, the upgrades to the Minuteman, the upgrades to the submarines, [deleted].

Senator THURMOND. General Chain, could I interrupt you just a moment for a question?

General CHAIN. Certainly, sir.

Senator THURMOND. How are the ICBMs based in your 1992 and 1996 analysis?

General CHAIN. The ICBMs in 1992, [deleted]. And I believe we will have—how about moving to the next chart?

Here is a reminder, sir, of what the force structure would be in 1992 [deleted].

Senator WARNER. Is Midgetman there?

General CHAIN. [Deleted] which is in the chart and I will talk about in a minute, [deleted].

Chairman NUNN. General, could you tell us how many ICBMs we get off and what we lose?

General CHAIN. [Deleted] the factors I just gave you. This is a [deleted]. In a minute, sir, I will show you what happens if we do not have a [deleted] and that by 1996, again because of your efforts in the modernization program, we get up to where I will have a very high degree of confidence to be able to carry out my mission.

And again here is the force structure. We still have the Minuteman IIs and Minuteman IIIs, 100 Peacekeeper, 50 of which will be deployed by then on rail garrison, [deleted] small ICBMs, an increase in the Trident subs, 100 of the B–1Bs, and [deleted].

Now I am going to show you a very important line, because this is against Soviet modernization at the same time we modernize, and if we had not modernized, if you had not supported modernization, here is where I would be—in here—and what I would be telling you.

This black line shows what our capability would be against the Soviet modernized force, given the same scenario and the same dates. [Deleted]—if you had not gone to the strategic modernization.

[Deleted.]

In 1996 [deleted]. Everything above that line is credited to you and your colleagues which have provided this country with that capability, and I could assure you what I would be in here telling you, if you had not done that, is that we could [deleted].

That is the base line.

Senator THURMOND. That has been done since what period? When did that start?

General CHAIN. Sir, that goes back to 1983, which would have started in the early eighties with the modernization programs that you all have supported, because the elements that are in here——

Senator THURMOND. In other words, this increase we gave you started in 1983?

General CHAIN. Yes, sir. But our data base—unfortunately I cannot go back to the seventies or what have you. This is as far back as my data base goes, and you are going to see in the next two charts that my data base for the next iterations does not even go back that far, which I cannot apologize for, but I just do not have the data.

Senator WARNER. General, this assumes the Soviets are going ahead with their mobility program dispersal?

General CHAIN. [Deleted] we continue to do the things that you all have given us capabilities to do, and therefore we come up a significant level in our capability to deter. And if we had not done it—and this is a good news/bad news story. The good news is we can be able to do it. The potential bad news is if we had not done it, we would be in terrible shape in this country.

Chairman NUNN. General, could I ask a question here just for clarification? I do not understand what you are weighing against each other to get that line. What program would have given us that black line there?

General CHAIN. Nothing. If we had not modernized. If we had not gone with B–1, if we had not gone with the Peacekeeper, if we had not gone with the small ICBMs, if we had not upgraded the submarines—if we had stayed with a static 1983 force and had done nothing but just continued to buy spare parts.

Chairman NUNN. This is not then a comparison, let us say, of the Reagan budget versus the Carter budget?

General CHAIN. No, sir, because President Carter had many of these same elements in it. This is not a Republican/Democrat, et al. This is a national issue and, as I have said once before in this committee, I would certainly hope that strategic systems would not denigrate themselves to end up being partisan politics. This is so important to our country, I just do not want to put any stamps on any of these programs.

Chairman NUNN. I agree. I just did not want it to be misinterpreted.

General CHAIN. No, sir. There were many things in President Carter's budget before he left office that are obviously included in this.

Senator THURMOND. General Chain, [deleted].

General CHAIN. There are several things in here, sir. [Deleted.] But if you are asking me what is my degree of confidence that in [deleted]. All I can do is rely on our best intelligence estimates for that year.

[Deleted.] So these are not finite numbers. Somewhere there is an area in here where the [deleted].

MEASURING WEAPONS CAPABILITY

Now if I could shift to the next scenario, which would be the same basic factors that we had—that a war [deleted]—this is our capability.

Again, the base line has to start with this year because we do not have the data to be able to go back into back years. But the obvious answer is that it would be even significantly less than what I am showing you right here. But our capability still increases, although the level of risk becomes more significant.

ATTACK SCENARIO—GENERAL NUCLEAR WAR

A period of increasing tension brings both United States and Soviet forces to fully generated alert.
[Deleted.]

And if we had not done anything and had [deleted] I would probably be forced to take off my uniform if this country had allowed something like that to happen—and they have not. The point is you get the credit for all of what is good above that line.

FACTORS

Generated forces.
Soviets initiate attack.
[Deleted.]

Now obviously we have a day-to-day responsibility—the "bolt out of the blue." What are we going to do against the "bolt out of the blue"—[deleted]. We have forces to be able to respond to a "bolt out of the blue" today—our day-to-day forces on alert. If we were attacked in a "bolt out of the blue" scenario, here is what our capabilities are.

[Deleted.]

U.S. DAMAGE CAPABILITY PROJECTION

Chairman NUNN. Could you tell us again what percentage of ICBMs survived in that chart?

General CHAIN. Yes. In this case we end up [deleted].

Senator WARNER. I am not clear on the difference between this chart and the previous one. I was trying to follow the questions. It is a totally-generated scenario?

General CHAIN. Yes, sir. The first two were totally generated, and the first one of the two was——

Senator WARNER. I understood that. Now this is day-to-day?

General CHAIN. This is day-to-day. We have [deleted] of the bombers on alert, about [deleted] of the submarines in position to be able to attack, [deleted] of the submarines at sea, survivable.

Senator WARNER. So what time frame are you operating in?

General CHAIN. 1987.

Senator WARNER. Your response time frame.

General CHAIN. [Deleted.]

Senator WARNER. How does this differ from a "bolt out of the blue?"

General CHAIN. This is "bolt out of the blue," sir.

Senator WARNER. All right. I am sorry to interrupt.

General CHAIN. That is what I am here for.

DAMAGE CAPABILITY PROJECTION

[Deleted.]

[Slide deleted.]

And if we had not gone through the strategic modernization program, [deleted].

[Slide deleted.]

Senator THURMOND. In other words, if we had not done what we did we would be in really sad shape; is that what you are saying?

General CHAIN. That is probably a gross understatement, sir. I just cannot tell you the state we would be in if you had not done things; the state this country would be in would be absolutely intolerable.

Senator WARNER. Well, really it is a lot of people who have done things—President Ford, President Carter, President Reagan, and Congress working together. Now you can evaluate who did what, but it was a coordinated effort.

General CHAIN. Absolutely, sir. That is the bottom line of what I am here to tell you today is that America has been very well served as a Nation by its leadership.

Senator GORE. General, if I could say, you are talking about things that we have done, and you are assuming on all of these charts that we are going to continue doing the things that we have started to do?

General CHAIN. Yes, sir. And if we do not continue to do it, it is going to be somewhere not as good as this, and obviously not as bad as this. I do not know where to put the tick marks because I do not know what will be completed and what won't. So it is somewhere in that area.

Chairman NUNN. General, have you plotted anywhere at this point what would happen if we got a 50 percent cut in both sides' forces like they are talking about?

General CHAIN. We have done some work on that, sir. It is not in this presentation, and we have not gone through that analysis. We certainly can and obviously we will. So I do not have anything to be able to give you today on that.

Chairman NUNN. If you could assume a 50 percent cut along the lines that we are talking about in our proposal at Geneva, when you do that analysis, would you furnish it to us?

General CHAIN. Yes, sir. I would be delighted to, and I would have to assume that the Chiefs, because the Chiefs have endorsed that, that the Chiefs have done that type of analysis already, but I will provide that to you, sir.

[Information referred to follows:]

FORCE REDUCTION

While my staff has not completed as detailed an analysis as the JCS, some trends resulting from a 50 percent cut in strategic nuclear weapons are apparent. [Deleted.]

Chairman NUNN. Okay. It would be helpful.

Senator EXON. Let me ask a follow-up question on that, General. You must have seen some preliminary results of the work that you have done. Could you give us an indication, without being specific, today whether our position would look stronger or weaker under that scenario that Senator Nunn has just outlined?

General CHAIN. I could not give you a bottom line, Senator Exon. I could say that since the Chiefs have endorsed it I have to assume that the position would not be weaker.

Senator EXON. Any worse?

General CHAIN. I could not think that it would be any worse, but that is based on what someone else has done and not my own looking into the matter.

So, going back to the first scenario, which I think is the most probable, this is where we are. This is where we should be in 1996, recognizing that every day beyond 1987 there are areas of great uncertainty. But if we had not done anything these are representative of the cases.

Senator WARNER. General, I think before we leave the question put by the Chairman here, when you say it would not be any worse, my judgment is it is doubtful we would be reaching this almost [deleted] there in 1992 and 1996 if both sides have cut their forces by 50 percent. So what do you mean by worse? Give us a base line for worse.

General CHAIN. Senator Warner, I would like to be able to do that, but as I say I am not here with facts and I do not want to give you an opinion. I do not think that is fair to you.

Senator WARNER. What did you mean by, "would not be any worse"? In other words, in the relative stability between the two nations? Certainly not the targeting. Presumably the targeting is going to be drastically reduced on both sides.

General CHAIN. [Deleted.]

Senator WARNER. [Deleted.]

General CHAIN. Exactly, sir, so the only category that would reduce would be in the [deleted].

Senator WARNER. Therefore you would not be getting the 1992 and 1996 [deleted]. I guess it would be, when you say it will not be any worse, maybe the stability between the two countries would remain the same.

General CHAIN. Again, Senator Warner, my problem is I am endorsing what the Chiefs have said, because I know they have gone through that analysis.

Senator WARNER. I guess I am perplexed that this thing has been around for some time now—this concept of 50/50—and it seems to me some little information should be dribbling out to you at least as to what the consequences would be.

General CHAIN. The consequences, as I say, the Chiefs have concluded that the consequences must be such that they can endorse it. My responsibility as the operating commander is to be able to apply weapons that are remaining against the target base that is remaining. We have done that and it would work, and I can come back and provide you with that information. I did not bring it with me today.

SUMMARY

The Nation's Strategic Modernization Program—
Was needed.
Well conceived.
Is progressing well.
You can take pride in its success.

A summary of what I tried to say is that this Nation's strategic modernization program has been a great success and obviously was needed. It was well conceived. It is progressing very well. And I think that the country can take great pride in the wisdom of its officials.

Senator EXON. General, does that——

General CHAIN. That completes the presentation, sir.

Senator EXON. Thank you very much. It was very, very interesting. We will go to the 6-minute rule. Let me start out by thanking you again for a very excellent presentation. If some of the questions stray today beyond what you were prepared to give us here today, please say so and we will not think any the worse of you for it.

SDI

When we are talking about this overall threat and what we are going to do with this budget, there are several very large proposals that we are looking at here, and I am sure questions are going to come up on some of these. Let me start out with one that I think a lot of questions are being asked about, and that is with regard to SDI and how that fits into the future—not now but into the future.

This was not projected on any of the charts. None of the information you gave us here today had any influence on any kind of an SDI deployment whatsoever, I presume. Is that correct?

General CHAIN. No, sir not at all. SDI, as far as I understand it, is still in research and development and what happens and when it is going to be deployed, when I am given that type of guidance,

then we can run up other calculations. But right now [deleted] that I have been talking about.

Senator EXON. So it has got nothing to do with that?

General CHAIN. No, sir.

Senator EXON. But looking forward into the future, one thing that I keep wondering about with regard to SDI is its possible vulnerability. I have supported SDI and will continue to support it certainly as far as the laboratory R&D is concerned, and I know that you are briefed on SDI and I know that you were involved in the planning—I assume you are. Are you not?

General CHAIN. Yes, sir.

Senator EXON. Would it be highly [deleted]. Is that a major concern to you or do you think that is being adequately addressed in these beginning stages?

General CHAIN. I am sure it is being adequately addressed by the Joint Chiefs as far as the warfighting and the offense and defense as they sort through their continuing support for the SDI program. [Deleted.]

WAR-SUPPORTING INDUSTRIES

Senator EXON. Let me jump to another area altogether. You mentioned the threat to our war-supporting industries, which a good planner like yourself would be concerned about. How much attention have you given in the military as to where our war-supporting industries are located? They seem to me to be pretty vulnerable to relatively short-range missiles from Soviet submarines, especially on the west coast. Has that been addressed and has there been any significant thought or planning in the military to better protect, possibly by relocation, some of our most important war-supporting industries, which seem to be located in places that are almost sitting ducks?

Do you get the thrust of my question?

General CHAIN. Yes, sir. [Deleted.]

So whether they are on the coast, they are not a time-urgent target, so whether they are on the coast or inland is completely immaterial from a war planner's point of view.

Senator EXON. From a war planner's point of view?

General CHAIN. Yes, sir.

Senator EXON. We could talk about whether they are survivable on the coast as they would be inland some place, but from a war planner's point of view—let me ask the question this way.

General CHAIN. [Deleted.]

Senator EXON. Nor are the Soviet war-supporting industries. But I suspect that they are more varied. Would it be more difficult for you to attack, as the SAC commander, than your counterpart in the Soviet Union in attacking the war-supporting industries?

General CHAIN. [Deleted.]

Senator EXON. Thank you.

Senator THURMOND. General Chain, I thought you made a very excellent presentation.

General CHAIN. Thank you, sir.

Senator THURMOND. I have a few questions I would like to ask you. You indicated earlier that your analysis assumes that we will

be able to [deleted]. What is the basis of your assumption that the Soviets will not have a similar capability?

General CHAIN. I have to assume that eventually the Soviets will be able to have that type of capability. The assumptions I make that we can [deleted].

And so I have to assume that someday they will be able to have a weapons system that will be able to try to find and attack mobile targets.

ICBM MODERNIZATION

Senator THURMOND. General Chain, do you support the ICBM modernization requirement of about [deleted] and what portion of that requirement calls for the unique capabilities of the single warhead small ICBM?

General CHAIN. We need them right today, sir—[deleted].

So we have got in the vicinity of [deleted].

Senator THURMOND. If only 500 hard target warheads are available in the Peacekeeper force would the priorities of our targeting policy permit 500 small ICBM warheads to be planned in a manner that capitalizes on their unique attributes or would they be planned to be substituted for the deficiency in Peacekeeper warheads?

General CHAIN. They would have to be rolled primarily into the [deleted]. And so until we ended up filling up that void, then the small ICBM would not be able to be capitalized on on its unique properties of having a single warhead that I could hold in reserve and then go after single-point targets. So I would not be able to maximize its potential capability.

TRIAD OF STRATEGIC FORCES

Senator THURMOND. General Chain, there has been some suggestion this year that continuing reliance on the triad of strategic forces is as much a technical issue as a policy issue. Do you agree that we could forego ICBM modernization if necessary improvements are made in submarime ballistic missile accuracy and submarine communications?

General CHAIN. Not at all. In fact, I would take strong umbrage with that conclusion in that I do not know what the technological breakthroughs are going to be tomorrow in anti-submarine warfare. [Deleted.]

[Deleted.] So I would hate to see this country try to bunch up its nuclear capability in any single leg. The great advantage of the triad is that it presents a synergism that presents the Soviet war planner with a problem that he is not going to be able to overcome. It is going to be laying things on a chess board that he is not going to be able to figure out.

So I am a strong supporter of the submarine. I'm also a strong supporter of the airbreathing bomber and ICBM leg especially and making ICBMs mobile because that again is going to add to the equation.

B–1B

Senator THURMOND. General Chain, we have received testimony that the baseline ECM system on the B–1B can be brought up to contract specifications with high confidence. We also understand that the threat against which this baseline system was designed has changed. What degree of confidence do you have that modifications to the baseline ECM system can restore B–1B penetration capability against the new threat and what priority do you attach to these modifications?

General CHAIN. I attach a very high priority to the modifications. [Deleted.] The threat in 1987 has evolved. In 1992 it will have evolved more, in 1996 will have evolved more. In the ECM world we will never be able to totally catch-up to the defender or those who are trying to shoot at us, because that is the way ECM in airplanes and attack aircraft interact.

But I have great confidence in the people that tell me that the fixes to the basic ECM problem are known and that system should be on our airplanes in the next year and a half to two years. However, I'm not the expert in that area, Senator.

Senator THURMOND. I believe my time is up, Mr. Chairman.

Senator EXON. Thank you, Senator.

Senator Quayle.

Senator QUAYLE. Thank you, Mr. Chairman.

U.S. DAMAGE PROJECTION CAPABILITY

General, would you put that chart back up on the U.S. damage projection capability on [deleted].

[Slide deleted.]

Going from the survivability from 1987 to 1996 we are going from 50 to 100 Peacekeepers, and you also assume we have—what else is your assumption in 1996? [Deleted.]

General CHAIN. Here are all the numbers, Senator.

Senator QUAYLE. So we assume an increase of Peacekeeper and we also have [deleted] particularly the [deleted]. On your chart there of 1987 to 1996, under [deleted].

General CHAIN. You have. And I apologize for not making myself more clear. If you did not do that, we would be down here; because you have done that, we are up here. This is what you gain. So it is not measuring just 1987. If I did not do anything, that line would come down. So if you froze in place what the Peacekeeper gives us, it is giving you this level of capability that you did not have.

Senator QUAYLE. How much is the small ICBM giving you?

General CHAIN. [Deleted.]

Senator QUAYLE. How much additional survivability is assumed in that chart?

General CHAIN. [Deleted.]

Senator QUAYLE. That is on the [deleted].

General CHAIN. Yes, sir. [Deleted.]

Senator QUAYLE. [Deleted.]

General CHAIN. [Deleted.]

Senator QUAYLE. [Deleted.]

General CHAIN. No, sir.

Senator QUAYLE. General, what would you say is—I am just thinking out loud—what do you think is the biggest problem that confronts you when you go to work in the morning and you think of all the different scenarios and everything? What one thing really concerns you?

General CHAIN. My basic responsibility in the Strategic Air Command is to provide this country combat capability. So it is not one thing.

Senator QUAYLE. There is not any one thing that really bothers you? I mean, there is not just one deficiency or something we could really see improvement upon? Do you have any one priority that we really need to try to concentrate on?

General CHAIN. The Nation's strategic modernization program is obviously the number one priority in the Command, which fits into the umbrella of combat capability. So, you know——

Senator QUAYLE. I guess I am just trying to get a specific, if there is anything. I know you want to talk in broad terms and all that, but I just thought if there was anything in particular that might give you a little bit of heartburn we would sort of be interested in it.

General CHAIN. There is a lot of arguments and debate on a lot of subjects which is obviously healthy in a democracy, but no, there is no one item that I am concerned about.

Senator QUAYLE. What about the [deleted]. Is that a problem?

General CHAIN. [Deleted] that we are going to face tomorrow. They have some [deleted] today, but as they go [deleted] it is going to present [deleted].

Senator QUAYLE. How are we going to find them, those targets?

General CHAIN. I can tell you in generalities right now and in specifics we would have to narrow down into another type of session which I was asked by the Chairman not to get to those levels.

Senator QUAYLE. Okay.

General CHAIN. But in generalities [deleted] if you would, and then use weapons like [deleted].

[Deleted.]

Senator QUAYLE. You say in another session at another level you could break it down a little further about how we go into fighting these things?

General CHAIN. Yes, sir.

Senator QUAYLE. I might ask the Chair. Senator Exon, I guess you do not want to get into it here, but sometime we might want to break this down into another level to find out how we are really going to find their mobile targets. He does not want to get into it now. You have asked him not to. But at some time it might be appropriate for us. It might only be individuals, but I think it might be of interest.

Senator EXON. I think sometime, maybe the next time the General is in, we will just go into one of the totally secure rooms and we can discuss that at greater length then. That is a good suggestion.

Senator QUAYLE. One other question, General. What about our need for ASAT capability from your view? Do we need this? How important do you think it is?

General CHAIN. From the Strategic Air Command's point of view we are not into that arena. That is the Space Command's area of

responsibility so I am not really a credible witness to answer that question.

Senator QUAYLE. All right. Thank you, Mr. Chairman.

Senator EXON. Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

I say it is a pleasure to see General Chain again. We have seen a lot of him lately and most recently it was at a sad duty we had in Omaha last Sunday at the services for a dear friend, Ed Zorinsky.

General Chain, let me ask you, last year your predecessor, General Welch, in response to a question which I had asked him, expressed his priorities on strategic modernization as, in order [deleted]. He recently appeared before this committee and I asked him whether he had had a change in view in terms of prioritization since becoming Air Force Chief of Staff. He said that he had not, and I just wonder do you concur in terms of the importance and the order that you would assign to prioritizing our modernization?

General CHAIN. Sir, I could endorse General Welch's prioritization. However, I would like to add the caveat that everything that you had in that priority list are things that, as the warfighting CINC, I require to be able to carry out my task. So I by no means want to denigrate my strong support for the small ICBM in endorsing the priorities.

DEFENDING CRITICAL MILITARY TARGETS

Senator WILSON. Let me ask you whether or not, given your mission to deny the Soviets their military objectives, do you believe that we have done enough to defend critical military targets from Soviet ICBM attack?

General CHAIN. [Deleted.]

Senator WILSON. Well, I think you are probably fully competent to render an opinion in another area, and that is given the assets that are your responsibility and given the obvious concern you have for their protection, would a useful strategic defense need to be, in your view, a perfect leakproof defense in order to be effective enough to meet your requirements?

General CHAIN. No, sir. Well, a perfect defense would obviously be the optimum goal, but if one missile was stopped from coming in or one warhead was stopped from coming in or one bomber was stopped from coming in or one submarine was stopped from shooting in the first place, we would save some of my assets, if my assets are the ones that are being targeted. So obviously, I am a supporter of defense.

Senator WILSON. Probably the best would be one that was sufficient, though by no means perfect, to discourage people from the notion of even making an attack.

General CHAIN. Yes, sir. I would agree with that.

SMALL MISSILE

Senator WILSON. Well, let me come back to the small missile. The presentation was made to us last week in terms of modernization by General May and Dr. Woodruff that their idea was 500 small ICBMs, 500 Peacekeeper warheads. They wanted a balanced force, but the cost of providing the elements were enormously dif-

ferent. Your endorsement for the small ICBM I want to test now in terms of cost effectiveness and your willingness to forego other weapons systems because of its preemptive cost.

General CHAIN. I endorse the President's budget that has been submitted to you in which the Air Force, at great pain, had to offset different things as it worked through the budget. And so everything that is in that budget, other things of high priority, have not been included. The small ICBM is included at full development funding. So obviously the Air Force is supporting that.

As the operating commander I have gone to the Air Force and said that I need the 100 Peacekeepers and I also need 500 small ICBMs to carry out the tasks which I tried to articulate in the briefing a bit ago. So as far as I am concerned the budget that has been submitted I fully endorse.

Senator WILSON. Well, you are not really responding to my question. I am admitting that I am attempting to lead you. It is because, it seems to me, that there is a necessity on the part of this committee, on the part of the Congress as a whole, to come to grips with the fact that these competing systems, and particularly within the time frame that we are envisioning their coming on line for production, for development and full production, I think is going to not just strain our ability, I think it is going to exceed it.

And I would say to you that I am sure you are aware it is no secret that there are a number of Members of this committee and a number of Members of the Congress who feel that strategic should suffer in order for us to beef up what is in their perception—and I think an accurate perception—less conventional capability than we would like to have.

So what I am trying to get you to do is to really—you have, I suppose, in terms of prioritizing, but I really think that not only the committee but the Air Force needs to come to grips with whether or not it makes sense to entertain the idea of a full-scale development and full production of the SICBM if we are simply temporizing by that decision in this budget. I mean, I think that what we have got is a balloon that is blowing up in the down years to enormous proportions. I just do not see how the Air Force can, notwithstanding the fact that it is in the President's budget, simply sign off on that.

It seems to me that we are all being more than a little irresponsible not seeing the crunch that is so clearly ahead.

General CHAIN. I did not hear a question in that, Senator Wilson, but I will make this comment.

Senator WILSON. The question is: Don't you agree?

Senator EXON. Not exactly.

General CHAIN. I would like, if I may, Mr. Chairman, to pick up on a point that Senator Wilson did make, and that is the support for improving our conventional capability. I strongly endorse that and we are taking significant initiatives in the Strategic Air Command to be able to help in that task by the use of the B–52 bomber, which I would be more than delighted to talk about, if asked.

Senator EXON. Thank you.

Senator Levin.

Senator WILSON. Thank you, General.

Senator LEVIN. [Deleted.]

General CHAIN. Perhaps one of my people knows. Does anybody know? Sir, I will have to provide that for the record because I honestly do not know. Obviously I did not bring the right experts.

[The information referred to follows:]

SS–18s

Assuming they have sufficient RVs, the Soviets could configure the [deleted]. To minimize missile off-alert time, additional RVs would probably be mated to the PBV at the supporting base and then switched with the existing [deleted]. Reconfiguring the entire [deleted] would require a major engineering effort involving a [deleted]. A change of this magnitude would require [deleted] and a test program to check performance.

[Deleted.]

Senator LEVIN. Would that be a concern of yours if they went from, say, [deleted].

General CHAIN. No, because the missile would remain one target as far as my responsibility to be able to attack it. They already have more warheads than they need to accomplish their damage goals in the United States, so if they added more warheads I do not know what they would do with them. More warheads would just allow them more redundancy or weapons in reserve.

I had a graph earlier, sir, [deleted].

Senator LEVIN. All right. [Deleted.]

General CHAIN. Sir, [deleted]. On the other hand, I have forces on alert today to hopefully deter that from ever happening, and I cannot believe any rational or even semi-rational leader of any world power, knowing what would happen in return, his country being basically rendered useless—would ever conceive in a non-critical scenario even thinking of "bolt out of the blue" or any nuclear attack.

You cannot win a nuclear war.

Senator LEVIN. Could you think of a rational or semi-rational planner hitting us after [deleted].

General CHAIN. [Deleted.]

Senator LEVIN. So then would you say it would be even more irrational, if that is possible?

General CHAIN. Yes, sir.

Senator LEVIN. [Deleted.]

General CHAIN. Yes, sir.

GREATEST NEED NOT FUNDED

Senator LEVIN. Now what is the greatest need that you have that is not funded in the budget?

General CHAIN. I guess I do not understand the definition of "not funded in the budget". I am not trying to quibble, but I have a sense that what we have asked for in the strategic modernization program, what has come to you in the strategic modernization program are all the things that I need, and therefore I do not have anything really hanging out that I have to say gee, you have not given me support or anything, if I assume the budget is supported, sir.

MIDGETMAN AND MX

Senator LEVIN. Have you given us your priorities in terms of Midgetman and MX?

General CHAIN. Yes, sir. I answered Senator Wilson's question a minute ago.

Senator LEVIN. I am sorry I missed that. I will not repeat that question in any event. I think that it was Dr. Ikle the other day who told us he did not know anybody in the Air Force that felt strongly about Midgetman, that the preference was clearly for MX. Has he not spoken to you?

General CHAIN. Obviously he does not know what I have said because I have just told Senator Wilson I am a strong believer in Midgetman and I will answer the same thing to you, sir.

Senator LEVIN. Was that something which the Air Force would have recommended even without the congressional either directive or prompting?

General CHAIN. When the dialogue was going on I was over in Europe as the Chief of Staff, so I was not in those forums, but I know it is in the budget. I know that CINCSAC, my predecessors immediate and one prior, have been supporters of that ever since the Scowcroft Commission, and I certainly follow that same line.

From the CINCSAC's perspective, the small ICBM is a very valuable weapon needed to do my job and I came in here to tell the committee it would be required.

Senator LEVIN. I do not want to be presumptuous. Am I correct in assuming that your answer to Senator Wilson's question was that you prioritized MX rail-basing mode above Midgetman if we were only going to go with one of them?

General CHAIN. Yes, sir.

Senator LEVIN. Can you tell us on a scale of, say, 1 to 10, if you rank wanting the mobile MX at 10, where would you put Midgetman? Would it be 9, 8, 7, 6, 5? How much below MX would you put it?

General CHAIN. If money was no object I would put it right up there with it. But knowing that the money is an object and we are talking about a multiple of four per warhead, then I cannot place it that high. If money was no object, from a warfighting perspective it is a very valuable weapons system.

Senator LEVIN. But given the financial constraints, we have got, how much below MX would you put it on your piority list?

General CHAIN. Not very much below, because again the only thing that Midgetman has against it is its price tag. If I could get the same warhead per dollar and the small ICBM as I did for the Peacekeeper I would be in here arguing for the small ICBM.

Senator LEVIN. The price tag being $40 billion to $50 billion?

General CHAIN. $40 to $50 billion versus $15 billion.

Chairman NUNN. If they were equal dollars, which one would you put first?

General CHAIN. For equal dollars I would prefer the small ICBM because it would give me everything that I can do with the Peacekeeper plus provide single warheads for flexibility in the targeting option.

Senator LEVIN. Thank you.

Senator EXON. I believe under the rules Senator Warner would be next. Do you have questions?

Senator WARNER. If I may. Senator Thurmond I think was here.

Senator EXON. Senator Thurmond has had his first round.

50 PERCENT REDUCTION CONCEPT

Senator WARNER. Gentlemen, I return to the series of questions relating to the 50 percent reduction concept. I would hope that you could provide this committee with your analysis, even though it may not be in finished form, as early as possible.

General CHAIN. Yes, sir, I will do that.

Senator WARNER. Because this is a continuing issue, it is important for us to keep abreast of the thinking of the professional military as we also keep abreast of the thinking of the negotiators and others involved.

You have made the statement several times that the Soviets have more than twice the number of warheads to take care of the targets in this Nation.

General CHAIN. Yes, sir.

Senator WARNER. I am just thinking in very simple terms. If they have more than twice and we cut that in half, then they have just an adequate number of warheads now to take care of the target base in this country. What have we achieved by a 50-percent reduction on both sides? That is an oversimplification of what you hopefully will provide us.

General CHAIN. I will get that material to you, sir.

[The information referred to follows:]

FORCE REDUCTION

While my staff has not completed as detailed an analysis as the JCS, some trends resulting from a 50 percent cut in strategic nuclear weapons are apparent. [Deleted.]

Senator WARNER. By the way, I thought your analysis was very interesting and clear. I was not, however, sure, of the status of the submarines which are in transit and ungenerated in that first scenario. Are you assuming some generation of those submarines?

General CHAIN. In the first scenario, sir, [deleted].

Senator WARNER. I am talking about the ones in transit.

General CHAIN. [Deleted.]

Senator WARNER. Then to what extent have your scenarios taken into consideration the contributions of other elements to a limited extent the Army's theater nuclear forces, other naval nuclear forces here and there? Or is that analysis totally the Air Force strategic mission?

General CHAIN. No, sir. This is the Nation's strategic, because the submarines are included in it.

Senator WARNER. Yes, I understand that.

General CHAIN. [Deleted.]

Senator WARNER. Sea-launched cruise missiles are not in there, elements of nuclear forces aboard carriers deployed are not in there?

General CHAIN. [Deleted.]

Senator WARNER. [Deleted.]

General CHAIN. No, sir.

Senator WARNER. That is all the questions I have right now.

Senator EXON. He was here for previous testimony on the B–1 and we are going to have him back very quickly. Senator Nunn has indicated he has no questions at this time and I am pleased now to recognize Senator Gore, who is not a member of the committee but has been a regular attender and we appreciate that. And I also appreciate your patience this morning, Senator Gore. I am very pleased——

Senator WARNER. Not a member of the subcommittee.

Senator EXON. Not a member of the subcommittee. I am very pleased to recognize you at this time.

Senator GORE. Mr. Chairman, thank you very much, and thank you for your courtesy throughout the hearings you have had here. There is a silver lining in the cloud of waiting until everyone has asked questions; you learn a lot that way. I do appreciate your courtesy.

COST AND SURVIVABILITY

I appreciate your testimony, General Chain. I am most impressed with the way you handled the issues and questions and I have a rather lengthy question which I would like to submit for the record. It concerns the cost and survivability about which you heard a good deal, and I would like to ask you for the record to respond to the question about cost and survivability within the context of the capabilities that we need for the mission which you are tasked to perform, with attention given to the full acquisition and annual operations costs of the various systems—Trident D–5 as well as the land-based ICBMs and other factors such as onstation availability, C^3I connectivity, and attack warning and the like.

I will not eat up my time here with the interchange, but if you would be willing to respond to that for the record I would appreciate that.

General CHAIN. Yes, sir.

[The information referred to follows:]

[See question for the record submitted by Senator Gore.]

TRIAD

Senator GORE. I know I heard you say very clearly that you are a strong believer in the triad and you think it would be a tragedy for this country to move away from the triad; is that correct?

General CHAIN. Yes, sir. that is correct.

Senator GORE. You also stated that you believe mobility is needed as part of our ICBM modernization program; correct?

General CHAIN. Yes, sir.

Senator GORE. You also stated while one of those charts was up there that on a [deleted] virtually all of our prospective [deleted].

General CHAIN. No, sir. [Deleted.]

Senator GORE. The [deleted]. That was the chart that you had when you made that comment. All right. Thank you for that clarification.

Now the Air Force has taken the position that it does desire Midgetman. I said to Mr. Ikle the other day—and I am sure it was inadvertent—that I felt that he had inadvertently misrepresented the Air Force's position on that, and I think you have reaffirmed it here today.

There is another issue if the budget forces a choice between the two systems. When is the proper time to make that choice? Some have spoken as if we already know everything we need to know about the rail-garrison system, and that no R&D is really necessary on that. Do you think we already know that the rail-garrison system can perform the mission and is survivable after 3 hours and that we have all the answers to the questions and therefore, if forced to make a choice, we can make a choice now before the R&D is done?

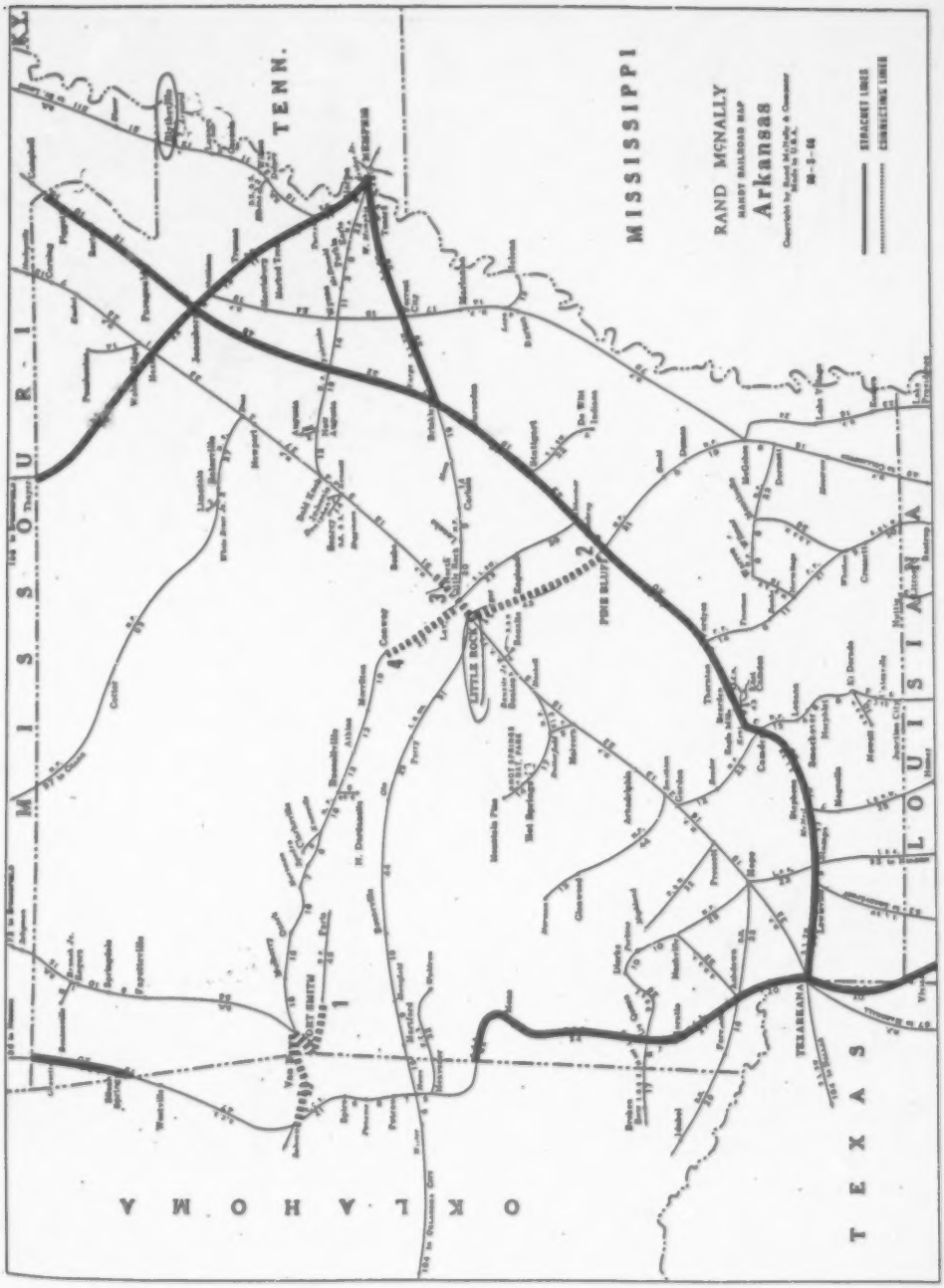
General CHAIN. From my perspective as CINCSAC and my perspective as an American citizen, I would not want us to have to be forced into a position of making that choice right now. I was asked another time at another hearing what the biggest problem with the rail garrison was. My response was, and I still consider it to be my biggest problem, is that I do not know what problems we are going to have because every avenue we have gone down we have not found problems, and consequently I would like to see more research and development. I would not want to see a decision made today that says, yes, this is what we are going to do and cancel something else, because that would do our country a disservice if we then ran across some insurmountable problem that I do not know about today.

Senator GORE. I certainly appreciate that response, and to summarize it, you think that it would definitely be premature to choose rail garrison at the expense of Midgetman at this point before doing the R&D.

Now I have raised some questions. I am prepared to support the R&D on this system, I think, but some of the questions that have been encountered—for example, if you assume a crisis in Europe and the beginnings of mobilization on both sides as we go to a higher state of alert, the very rail lines that would be required for mobilization are, in most cases, the same rail lines that would have to be kept open for the rail-garrisoned MX to travel on.

I have provided maps or will provide for the record maps of civil defense rail lines that are essential for mobilization and for national defense.

[The maps referred to follow:]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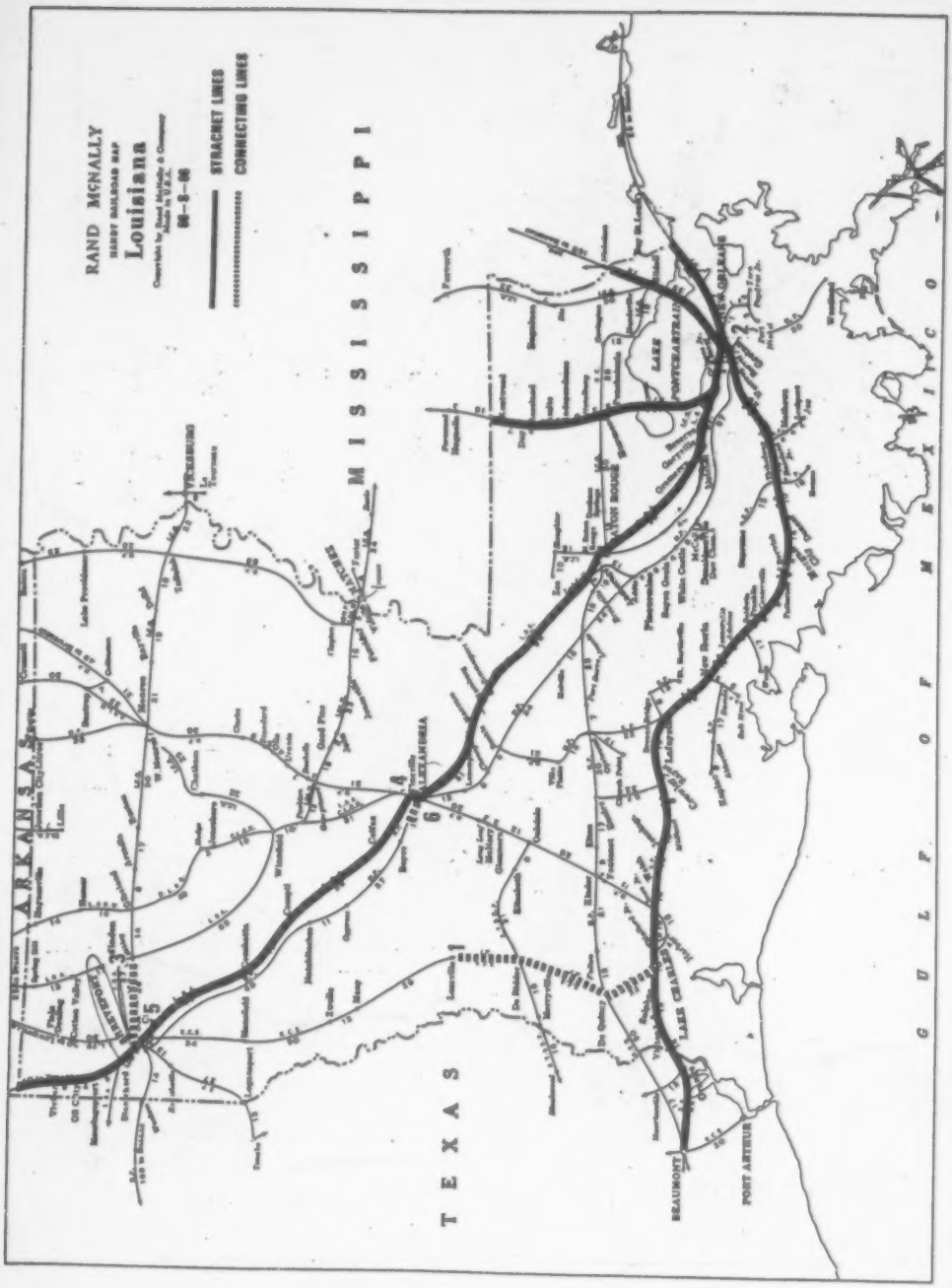
HANDY RAILROAD MAP
Arkansas
STRAIGHT LINES
CONNECTING LINES
MISSISSIPPI
TENN.
KY.
MISSOURI
OKLAHOMA
TEXAS
LOUISIANA
LITTLE ROCK
FORT SMITH
HOT SPRINGS
PINE BLUFF
TEXARKANA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STRACHEY LINES
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ARKANSAS
MISSISSIPPI
TEXAS
GULF OF MEXICO
SHREVEPORT
ALEXANDRIA
LAKE PONTCHARTRAIN
BATON ROUGE
NEW ORLEANS
LAKE CHARLES
BEAUMONT
PORT ARTHUR

LAKE SUPERIOR
STRACNET LINES
CONNECTING LINES
RAND McNALLY
HANDY RAILROAD MAP
Michigan
88—S—88
ONTARIO
LAKE MICHIGAN
LAKE HURON
WISCONSIN
GREEN BAY
LAKE HURON
LAKE MICHIGAN
SAGINAW BAY
GRAND RAPIDS
FLINT
DETROIT
LANSING
JACKSON
KALAMAZOO
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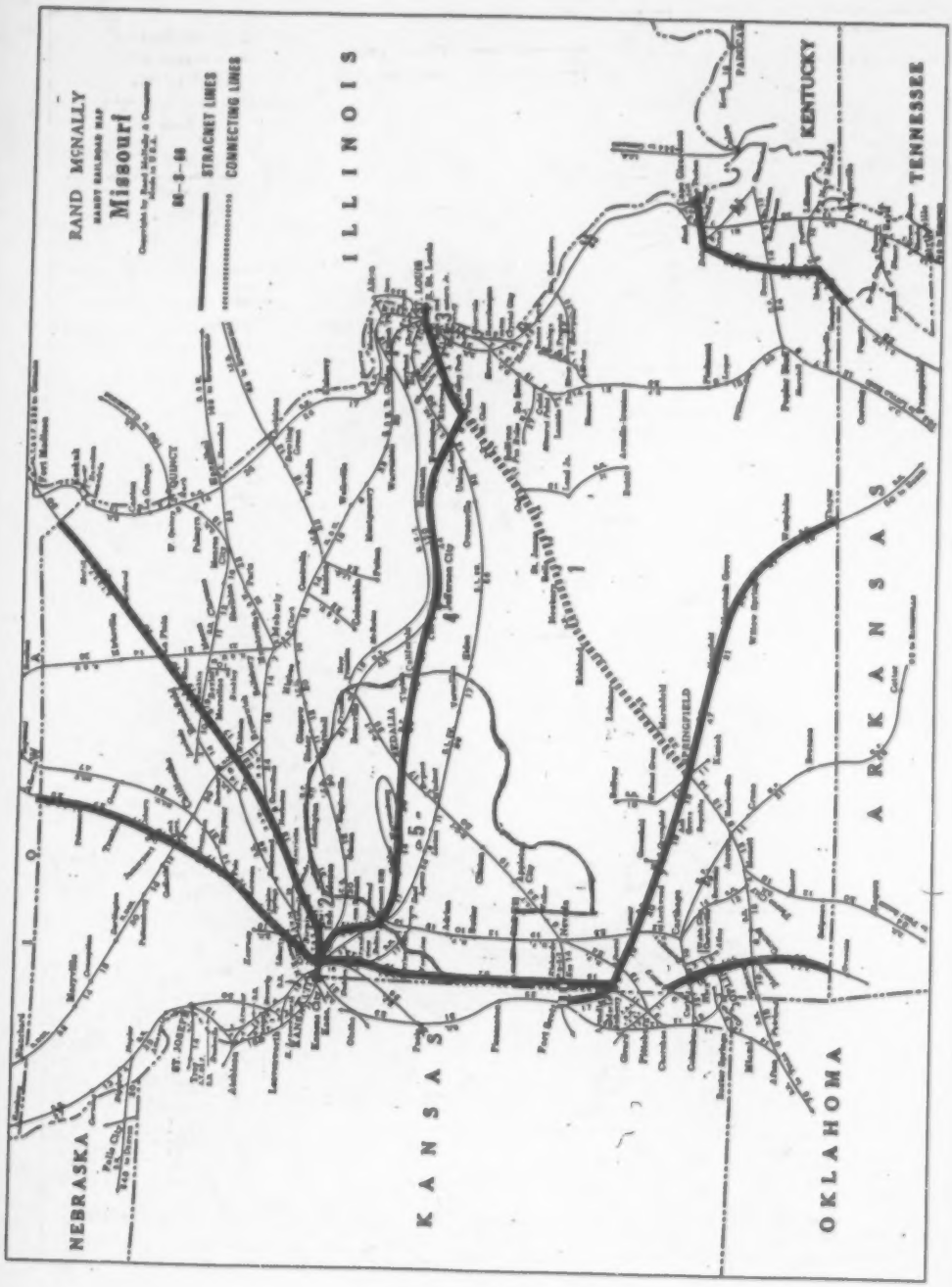
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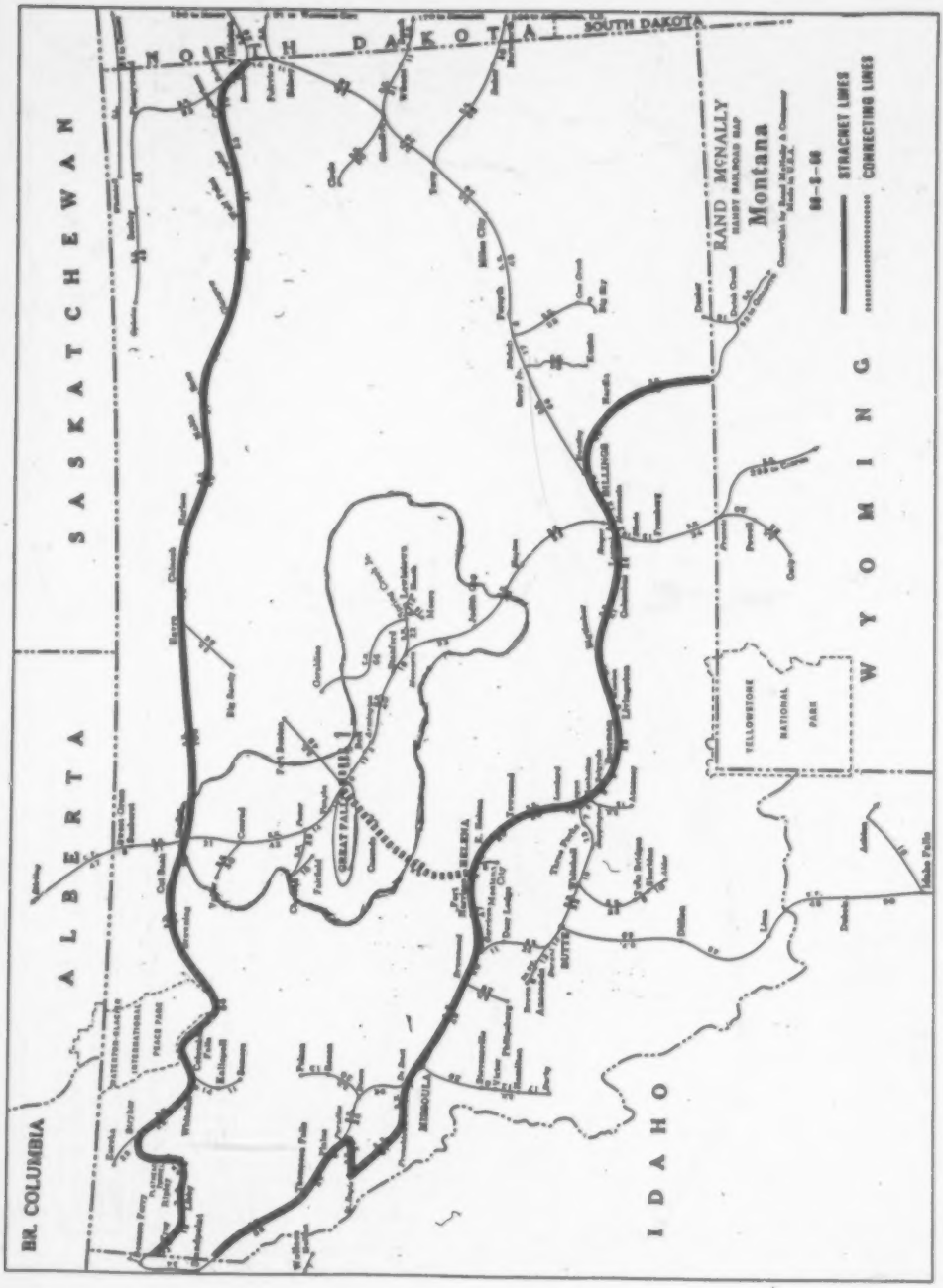
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SASKATCHEWAN
ALBERTA
BR. COLUMBIA
WYOMING
IDAHO
RAND McNALLY
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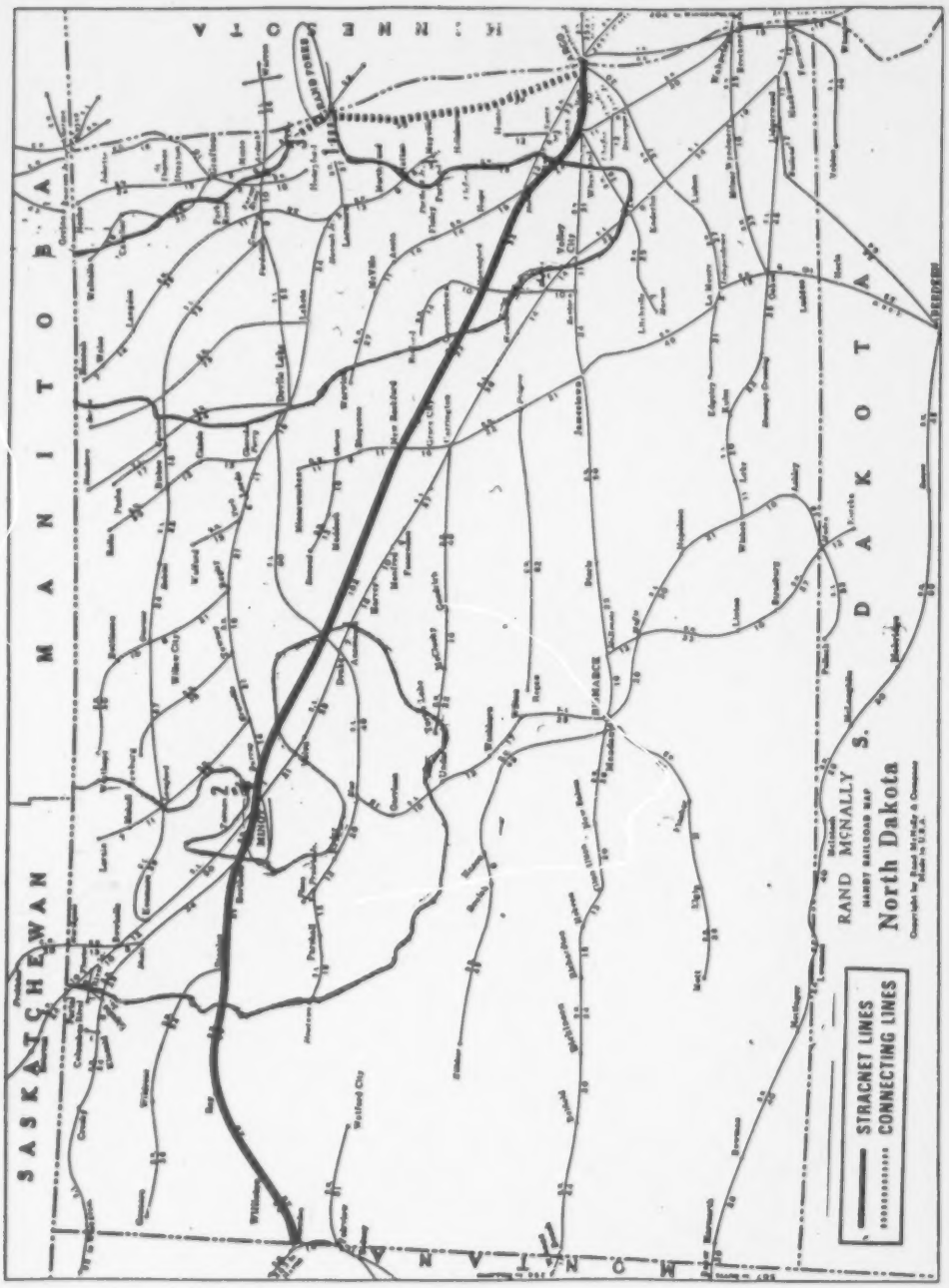
GREAT FALLS
HELENA
BUTTE
MISSOULA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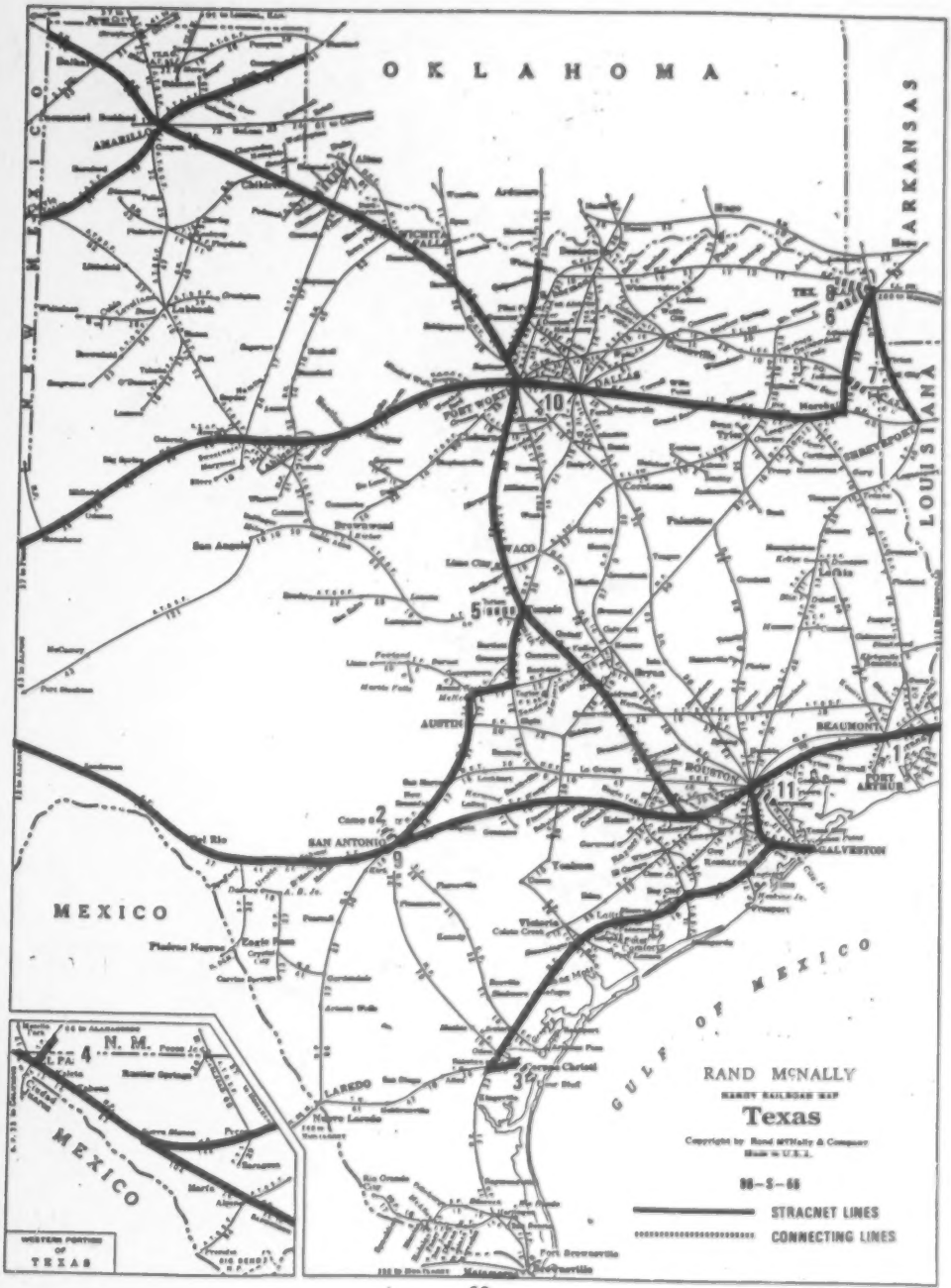
51 (Revised)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SHREVEPORT
WACO
AUSTIN
SAN ANTONIO
HOUSTON
BEAUMONT
PORT ARTHUR
GALVESTON
LAREDO
Nuevo Laredo
Del Rio
Piedras Negras
Eagle Pass
Corpus Christi
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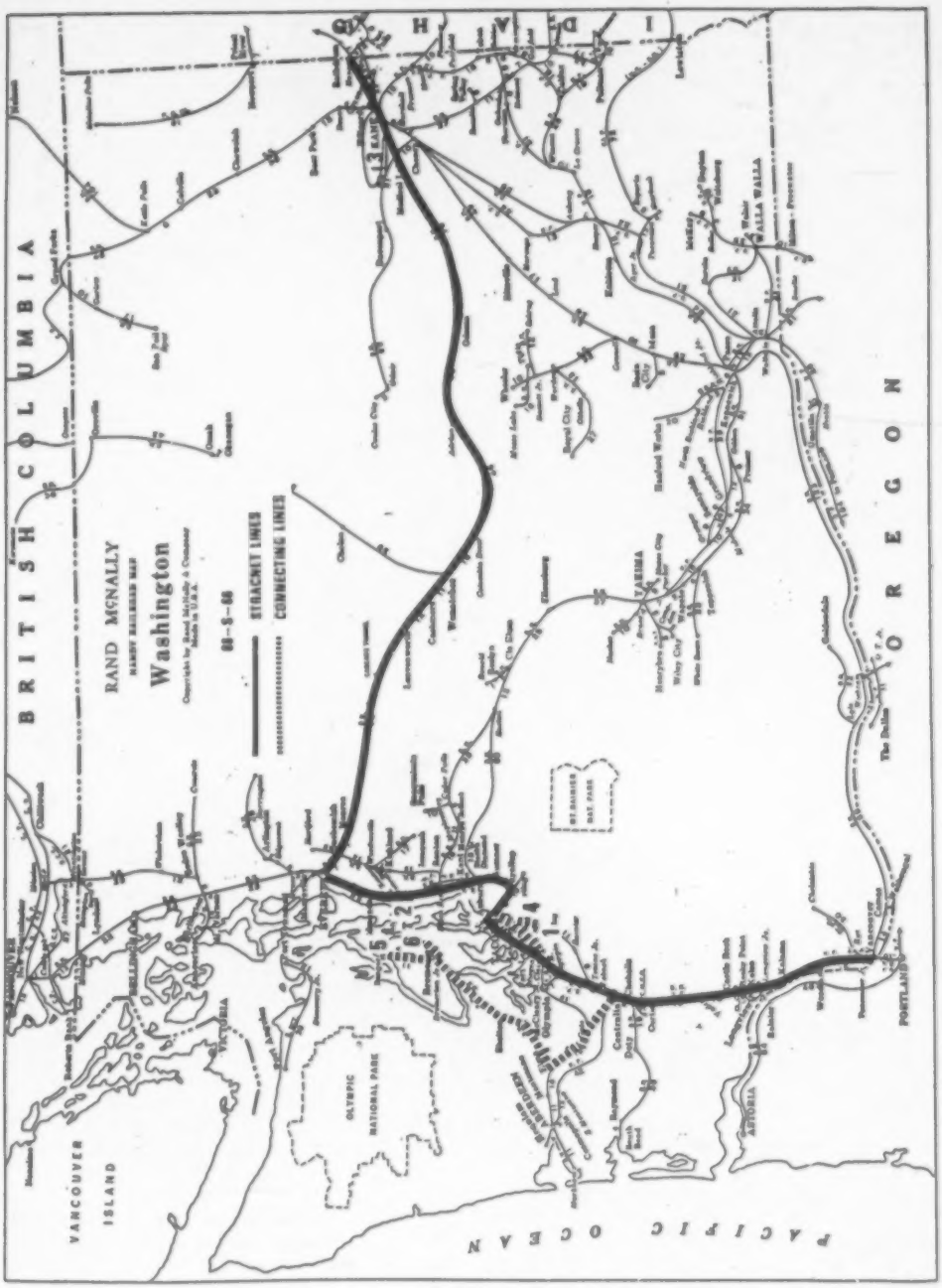
N. M.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88-5-50
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PACIFIC OCEAN
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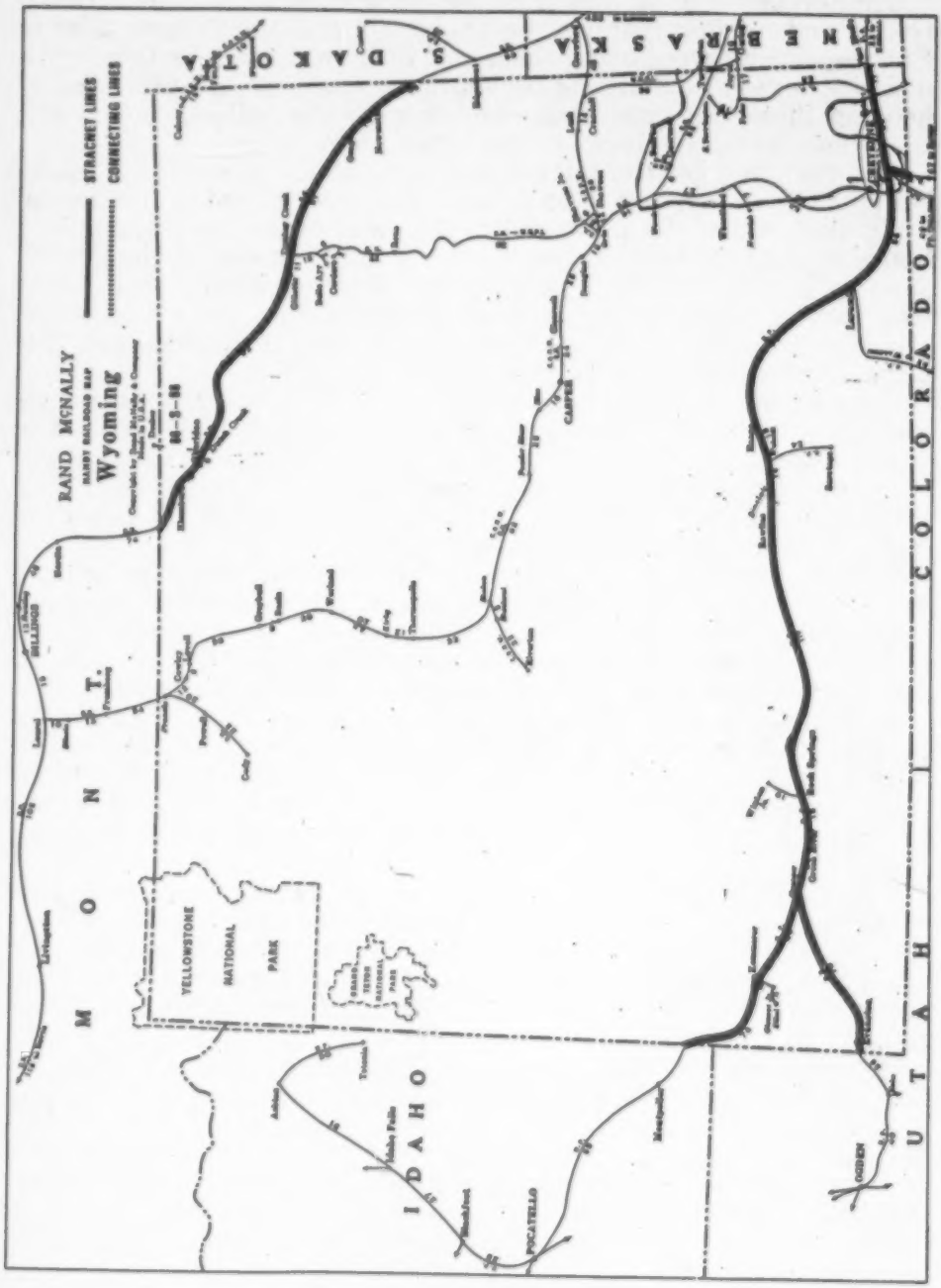
MT RAINIER NAT. PARK
VICTORIA
PORTLAND
ASTORIA
YAKIMA
WALLA WALLA
The Dalles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UTAH
IDAHO
MONT.
YELLOWSTONE NATIONAL PARK
GRAND TETON NATIONAL PARK
POCATELLO
OGDEN

Senator GORE. If at the time we were calling up the National Guard and moving materiel for the C–17s and the C–5s to take to Europe, and we were using these rail lines, we would be faced with a choice between mobilizing conventional forces on the one hand or keeping those rail lines open and clear for the rail-garrisoned MX to achieve its survivability on the other hand.

And then you get the further questions about where these tracks can take it during the 3-hour period. I have stated a number of times that one of the preferred deployment areas has it going in 3 hours from Little Rock to New Orleans, and that makes the French Quarter part of its refuge area for survivability during that 3-hour time, not to mention the questions about whether the tracks themselves will accommodate the weight and speed of the train as it is prospectively configured.

But my time is up at this point and I will submit that as a question and the one I referred to earlier, and I will look forward to your response.

Thank you very much for your testimony here.

General CHAIN. Thank you, sir. I would like to just make a comment on your last set of statements.

One, we are talking about [deleted] trains that would be blended into a system of 200,000 miles of track, about 3,000 train movements a day, and 1,500,000 railroad cars.

Senator GORE. Are you talking about the full U.S. rail system?

General CHAIN. I am talking about the full U.S. rail system.

Senator GORE. But, General, the rails that are designated for the garrison mobile system at this point represent only a tiny fraction of that system. I do not want to take the time to put the vugraphs that I prepared on this up here, but the proposal designates particular rail lines that come out from the proposed deployment areas.

General CHAIN. That is just to get on the Nation's highway, sort of the difference between the secondary roads and getting on Shirley Highway, I would say. Twenty-five trains blended into 200,000 miles of track is sort of like somebody coming off a secondary road out of Fairfax and getting on the Beltway in the morning. It is just going to be blended in there.

We have worked closely with the Federal Railroad Administration and I do not have the same element of concern. The 3 hours is a very interesting figure, but I am not looking at 3 hours for generation. I am looking at days, if not weeks, of generation because when you get into a scenario where you are at war in Europe you will be in a higher state of alert in this country. [Deleted.]

And as far as a train being outside of New Orleans or outside of Memphis, [deleted].

So I am not looking forward to moving them out of garrison. I am certainly not looking forward ever to having those things fired. And the day that we have to move them out of garrison that may keep a nuclear weapon from landing in New Orleans.

Senator GORE. If we have another round I will pursue it, Mr. Chairman.

Senator EXON. Thank you. We are now about to begin the second round. I wanted to poll the commitee to see if there are additional questions as we now have the authority to proceed to 11:30. We can

continue, but we have to notify the cloakroom under the rules, which we will do. I would like to get some indication as to how much time it would take. I will take another 6 minutes at the outside.

Senator QUAYLE. I will only take a few minutes.

Senator EXON. Senator Levin. And do I take it you would like another 6 minutes?

Senator GORE. Well, if you are going to go for another round, I will, but I am willing to forego it if everyone else is.

Senator EXON. We are just getting a poll. Will you so advise the cloakroom? We will continue.

What about your time, General?

General CHAIN. Senator, my time is your time.

Senator EXON. Thank you. You are a good soldier.

Could you put this chart back up on the vugraphs once again? We enjoyed your charts this morning.

General CHAIN. There are four with bar graphs. If you could tell me what is the title.

Senator EXON. [Deleted.]

[Slide deleted.]

While that is going up there, let me ask the question so we can save a little time, General. First, there has been a great deal of talk about what is premature and what is not premature. One thing that is premature with this committee is that we do not yet have a budget, yet we are going to have to send out a budget authorizing what we think should be authorized. So some of the information that we are seeking may be premature from some people's point of view, but it is very timely as far as moving our recommendation out to the floor after it gets out of subcommittee and out of the committee itself.

So some of these questions that we keep asking, while they may be somewhat redundant, I hope you will bear with us, General, because we are trying to make some important decisions.

I want to ask you about that first graph on the left called nuclear. It goes up to [deleted] and it shows that if we do not modernize under the moderanization program that you outlined today we would be [deleted] that we think is there now. So I am talking about the difference on the nuclear bar graph and the right blue line under [deleted].

If I understand it correctly, where that comes out on the chart there up to top is what the modernization program that we are now involved in would entail. I do not supose you have the information today, but I would very much appreciate you supplying for the record, if you can, in the near future—hopefuly before mark-up—as to which of the differenct increments of our moderization made up that. In other words, there would certainly be something in there. The B–1 has part to play in that. The MX rail-garrison would have a part to play in that. The Midgetman would have a part to plan in that. Also, the rest of our air-breathing leg. Would it be possible for you to supply us for the record the size of the different increments of the modernization programs that make up that improvement?

General CHAIN. Yes, sir.

Senator EXON. Do you have any response to my question at this time, Would you rather just answer for the record?

General CHAIN. I would prefer to answer it for the record, sir. We could be more specific. I refer you to this other chart, sir, and you can see that we have 71 B–1s in the basic 1987 line because this is the line to the end of the particular fiscal year, and in 1996 we have all 100 B–1s. The significant difference is we have got 27 Peacekeepers in 1987 and we have all 100 Peacekeepers, the second 50 on rail garrison, by 1996.

[The information referred to follows:]

MODERNIZATION PROGRAM

The target category you are referring to is designed [deleted]. In our analysis of future capability, we apply current [deleted]. With that baseline, the total effectiveness against only the [deleted] resulted from the following allocation of weapons. [Deleted.]

[Deleted.] The probability of damage varies from weapon to weapon and target to target. [Deleted.] The contribution of [deleted] delivered weapons is higher in other [deleted]. Further, [deleted].

General CHAIN. We have no small ICBMs in 1987. We have [deleted]. And we increase the amount of submarines with the D–5 in particular in the Trident boats. So those are the elements that go into that. But I can break that down by weighted effort. I apologize that I cannot do it off the top of my head.

Senator EXON. I understand. We did not expect you would, General, but if you would get that for us before we go to markup it would be very helpful to us, because I know, I feel we are going to have an in-depth discussion on that. We do need your input and advice.

This is a question not intended to put you on the spot, but my relationship with you has been that I have always admired you because you never seem to mind being put on the spot. I seem to sense that you feel that we need this information here because we have to make decisions and to a man on this committee I want to keep telling the military that although we have to make tough decisions here, there is only one thing that we fear. I think that is not having all of the information from you people that we need to carry out our actions.

So that is why we keep pressing. Not to put you on the spot but to help us out, let me ask you this question: If you had a choice between 100 additional MX missiles over and above the 50 that we have already agreed to or the Midgetman, which would you prefer?

General CHAIN. If I had a choice on warheads only, you know, equal number of warheads, I would prefer the Midgetman. If I was given dollar value and say get as much combat capability out of a given amount of resources, I would prefer the Peacekeeper in a mobile mode, I might add, because I happen to feel very strongly about the mobility and that has to be an integral part of our deployment pattern.

TRUCK-GARRISONED PLAN

Senator EXON. Let me ask one last question, then. How much research has there been or how much attention has been given to a truck-garrisoned plan or program?

Have you given that very much consideration? Is it a possibility?

General CHAIN. It is certainly a possibility, sir. We do have the factors involved in that, and I can provide that to you for the record. Off the top of my head, without being able to give you finite details, it turns out that the weight of the vehicle becomes rather significant, the size of the vehicle, because of bridges and what have you becomes rather significant, the security that would go with that vehicle when we flushed it ends up being more significant.

I am not denigrating it at all. It is a concept that has merit, but from what I have been told and have looked at there are some problems with it that perhaps could be overcome, and I will provide you with the raw data.

Our conclusion is that it is not as cost effective as it is with the rail garrison, but it would be a very good system—more expensive and more relative problems.

[The information referred to follows:]

[No additional information submitted by SAC.]

Senator EXON. Thank you, General. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

I want to follow up on one question of the Chairman. General Chain, could you provide for the record the sensitivity of your analysis in each of the [deleted].

General CHAIN. I would be delighted to, sir, and that chart right there sort of sums it up because the growth in our capability is wrapped up principally in those two systems. I will give you for the record the details.

[The information referred to follows:]

SMALL ICBM AND PEACEKEEPER

The goal of ICBM modernization was founded on the need to correct the serious imbalance in strategic counterforce capability. Our current plan, reflected in the chart, includes the deployment of 50 rail-based Peacekeeper missiles (490 operational warheads) by the end of 1993 and a notional 192 single-warhead small ICBM missiles, based in hardened mobile launchers, by the chart's baseline year of 1996. (We have not yet determined the number of small missiles required.)

The loss of all these weapons through program cancellations would be severe. The loss would be felt, however, not in the totals depicted on the chart, but instead in the disportionate loss in prompt damage capability to key Soviet counterforce targets. This loss would be felt regardless of scenario. Moreover, the application of less effective ICBM weapons, in terms of target damage, to hardened Soviet targets, would further reduce the efficiency of our strategic deterrent by forcing U.S. planners to apply multiple weapons to such targets in order to achieve a level of damage equivalent to a single Peacekeeper warhead.

Senator THURMOND. General Chain, I was surprised to hear that the budget did not leave you short this year. Does this conclusion also apply to the tanker reengining request which was reduced from 50 to 36 in the request?

General CHAIN. Sir, you could double my budget and I would still have things that have left me short. I was trying to be as honest with you and straightforward. There are lots of things that are very high priority, but if I had one more dollar I would put it into the tanker reengining, and if I had another new dollar I would increase the flying training. If I had another dollar I would increase our conventional capability. So there are many things that I want. I just wanted to tell you that within the budget that I have been

allocated, or at least to be able to request from you, I am going to be able to provide this country adequate combat capability to do my task.

There are other things that I would like very much to have.

FLIR MODIFICATION

Senator THURMOND. General Chain, what is the operational rationale for the FLIR modification to the B–1B and what priority do you attach to this modification?

General CHAIN. The FLIR, sir, will be used. The reason I want the FLIR is because of our conventional capability with the B–1. The B–1, as you know, will be able to carry 84 conventional bombs internally. [Deleted.] With its low altitude capability, its high speed and its low-radar cross section and its ECM capability in the same time that the FLIR is going to be available, I will be able to use those capabilities in a conventional role. Primary to attack conventional deep imprecisely located targets in the strategic area of responsibility.

Obviously there would be some spinoff into the nuclear mission, but the real desire and reason we would like to have it in the outyears is for its conventional capability.

B–52 MODIFICATION FUNDS

Senator THURMOND. General Chain, I believe that $142 million in fiscal year 1987 B–52 modification funds are currently in the category of appropriated in excess of authorization. What priority do you attach to the release of those funds and what are the operational implications if the funds are not released?

General CHAIN. I attach high priority, sir, and one of the things we did not get into in this discussion today is SAC in the conventional role. I think that we can provide our country a great deal of capability which will expand the difference between conventional war and nuclear war so we never have to get into the nuclear war.

Most of those moneys that you talked about end up enhancing the B–52G to have it be employable in a conventional role. So it will be a very valuable asset to our country.

SRAM

Senator THURMOND. General Chain, in the SRAM report to the Congress last year the primary argument for a new [deleted]. Do those same arguments pertain today as you assess the merits of upgrading the existing SRAM versus purchasing an all-new missile and what is your bottom line with regard to the need for a new missile?

General CHAIN. The new missile is required, sir, for two reasons. [Deleted.]

But my even greater requirement is the warfighting capability that a SRAM–II will give me. Let me give you a couple of for-instances. [Deleted.]

[Deleted.] I cannot justify those numbers; they are just what I have been told, but from a combat capability point of view, it will be a very valuable weapon and will help me do the job that I am asked to do.

MINUTEMAN

Senator THURMOND. General Chain, I believe the Department plans to retain the Minuteman force for the indefinite future, operating the components as required.

General CHAIN. Yes, sir.

Senator THURMOND. At the same time the Department proposes to replace the SRAM–A missile which has technology from the same era. What factors account for the differing approaches to maintaining the capability inherent in these systems?

General CHAIN. The way that we use the two weapons is different. [Deleted.]

I do not see that they compete against each other at all, sir.

Senator THURMOND. Thank you, General. I believe my time is up, Mr. Chairman.

MX

Senator EXON. Thank you, Senator.

Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

General, you indicated you feel strongly about mobility and I think most of us would share that view. I share that view. Are there any plans to make mobile the first 50 MX that are in fixed silos if indeed we ever move to the rail garrison?

General CHAIN. Right now there are not, but I can tell you, obviously, that once the rail garrison is fielded I think that in the early 1990s, and assuming it is a successful system, that I believe the country ought to give very serious consideration to making those first 50 mobile. [Deleted] and for the cost differential of taking them back out of the hole and putting them on trains it would today appear to make good sense.

MINUTEMAN

Senator LEVIN. We are told, I think by your predecessor, that the Minuteman was good through the nineties. Is that the current assessment?

General CHAIN. In 1996, sir, we have still got the same Minuteman that go all the way back to 1983, and they go back into the seventies and the sixties. There will be upgrades on them and with the things that have been done it continues to be a better weapon, but in 1996 we will still have 950 Minutemen.

Senator LEVIN. Do you know whether that will continue into the next century as far as we can tell now?

General CHAIN. As far as the planning is concerned right now, they would. I do not know what type of plan would be done, and obviously if we come down the 50 percent that the negotiators are talking about that is the 50 percent.

Senator LEVIN. The current planning, assuming no arms control cuts, allows it to go into the next century?

General CHAIN. Yes, sir. But our planning really does not—we are in never-never land as soon as we start talking about the next century.

Senator LEVIN [presiding]. I guess I am, too.

I guess I am the Chairman. I think Senator Quayle is next.

Senator QUAYLE. Thank you, Mr. Chairman.

CONVENTIONAL ROLE OF SAC

Let me just ask a couple of quick questions. You have mentioned a couple of times your emphasis on the conventional role of SAC. I was wondering about the idea of developing a [deleted].

General CHAIN. Exactly what I am interested in, sir. The first thing that we need to do—and we are trying to run some tests right now—because the technology exists is to get some [deleted].

Senator QUAYLE. [Deleted.]

General CHAIN. That is what I am going to get to. [Deleted.]

Senator QUAYLE. Well, where do we stand on developing [deleted] on some of these B–52s?

General CHAIN. That is exactly what we are trying to do in the Strategic Air Command and I have gone forward to the Pentagon. I am glad that you asked so that I can give you this response. I am very enthusiastic about the idea, and it is something that would provide the theater commander a great deal of increased combat capability. So we have gone forward asking for the modifications. It goes back to Senator Thurmond's question about the money that we need in the near term to start doing the testing and getting the wires in the aircraft so we will be able to do this.

B–52

Senator QUAYLE. Is there money in this budget request for the development of [deleted] on some of the B–52s?

General CHAIN. No, because we did not get into this until this fall, and that budget had already been submitted.

Senator QUAYLE. There is no money in there?

General CHAIN. [Deleted.]

Senator QUAYLE. Well, I would like to work with you and some of your staff to pursue this possibility of how we can get this [deleted]. I think it would be very, very important and it overlaps, you know, the strategic and conventional. I know Senator Levin and I have talked a little bit about this. We have talked about it at another hearing, as a matter of fact, on the need for increased [deleted]. There is just another area where we have really got to pursue it, and I think that listening to the priorities today and what we got at the last briefing, I think we might want to do a little pushing and cajoling.

General CHAIN. Sir, we would be delighted to work with you and we would be delighted if this committee as a body would take that up as a personal interest item because I think it will serve our country very, very well.

Senator QUAYLE. OK. You can rest assured we will be in touch with you to try to see where we are and build on that.

Thank you, Mr. Chairman.

Senator LEVIN. Thank you.

Senator Gore.

Senator GORE. Mr. Chairman, I would like to submit two or three questions for the record. We have a vote on. I would appreciate your response.

Thank you.

Senator LEVIN. General, we thank you for coming. This meeting is now adjourned. The record will be kept open for 24 hours for questions for the record.

[Questions for the record with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR ALBERT GORE

DEPLOYMENT OF HARD TARGET CAPABILITY

Senator GORE. We have been addressing the issue of relative cost of deploying prompt hard target capability in various modes, but mainly in the form of rank ordering price per warhead. I think it would be appropriate for General Chain to provide us an approach to this question (how to deploy prompt hard-target capability) which takes into account factors that relate costs to missions, and to the operational capabilities required for those missions. In short, this means a full costing of acquisition and operations to accomplish—under a variety of assumptions—the military mission of holding time-urgent, hard targets at risk. Factors that would have to be addressed include:

(1) A definition of [deleted].

(2) A definition of "hard targets" and their numbers, and of what the concept "held at risk" means.

(3) A translation of these terms into costs as follows: "What is the full acquisition and annual operations costs of Trident/D-5 and, separately, land/based ICBMs to accomplish the above mission (holding time-urgent, hard targets at risk)?" Land-based ICBMs should for this consideration, be either small missiles in hard mobile launchers *or* MX in garrison rail mode.

(4) Factors such as on-station availability, and Command and Control connectivity, should be taken into account in relation to: attack warning—ranging from hours to tactical only; applied Soviet threat level; reliability, penetrativity and accuracy of U.S. systems.

General CHAIN. In underwriting U.S. nuclear deterrent strategy, the Peacekeeper Rail Garrison, small ICBM, and Trident D-5 will provide a broad range of capable, flexible employment options of use against the full spectrum of counterforce targets. These [deleted].

In assessing the capabilities of these systems, we measure them against the [deleted]. We use this benchmark because it comprises the Soviets' [deleted].

Given your criteria, we weighed capability against the 20 year life cycle costs of these systems. All costs are expressed as cost per alert warhead. Peacekeeper rail garrison provides greatly increased survivability in a deepening crisis and a very high alert rate at approximately ⅔ the cost of the initial deployment of 50 Peacekeeper in Minuteman silos. The Trident D-5 will provide enduring hard target capability and new response options, but is approximately twice as expensive as the initial deployment of Peacekeeper. Finally, the SICBM combines the attributes of fixed ICBMs as well as SLBMs. That is, it has a high alert rate, assured connectivity and long endurability. The issue is cost. It is nearly 2½ times more expensive than the initial Peacekeeper deployment.

RV REQUIREMENT

Senator GORE. The intelligence community is predicting a roughly [deleted]. The end result is a projection of only about [deleted]. Given this, is your requirement for a minimum of [deleted].

General CHAIN. The intelligence community also predicts that the Soviets will [deleted] ICBM [deleted] which requires attack by high quality, hard-target RVs such as those provided currently by Peacekeeper. However, the Soviets continue to [deleted]. These [deleted] along with increasing numbers of [deleted] represent a significant portion of the threat that Peacekeeper was designed to counter. Thus, the requirement for counterforce RVs should not change appreciably by the retirement of older missile systems.

RV REQUIREMENTS IN AN EUROPEAN WAR

Senator GORE. Assuming NATO's doctrine is unchanged, in the event of a war in Europe, [deleted] as today aren't there likely to be very few withheld [deleted]. If so, is there still a need for no less than [deleted] very capable counterforce RVs? Why not rely more on bombers?

General CHAIN. The key is might. [Deleted.] These [deleted] represent a significant portion of the threat that modernized ICBM RVs are designed to counter. The number of hardened leadership facilities, command and control centers, and related counterforce targets are also increasing. It is this critical, increasingly hard component of the Soviet target base, many of which require prompt response—something bombers cannot furnish. Prompt, high quality, counterforce ICBM warheads will ensure we can hold these hardened strategic assets at risk and provide a solid foundation for deterrence.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

SUSTAINING PEACEKEEPER AND SMALL ICBM DURING ALERT

Senator THURMOND. How do you assess our ability to sustain Peacekeeper missiles on the Nation's rail network and small ICBMs, deployed in Hard Mobile Launchers during extended periods of alert, both before and after the initiation of nuclear hostilities?

General CHAIN. We are confident we can adequately sustain both weapon systems during extended alert. Sustaining Peacekeeper missiles on trains is a function of maintaining on-board supplies, consumables, fuel, and spare parts. Before initiation of a nuclear exchange, we can sustain a train indefinitely in garrison or when dispersed. When dispersed, we could return to a garrison base for resupply or sent provisions to the train. We are planning sufficient on-board supplies and personnel to sustain about 2 weeks of autonomous dispersal operations. We may choose to add supply cars to the train for extended endurance. System maintenance design will allow for on-train removal and replacement of many critical missile and support parts. This flexibility provides excellent long-term sustainability before or after an exchange.

The operational concept for small ICBM on Minuteman facilities does not call for dispersal before tactical warning of attack. Therefore, we can sustain the Hard Mobile Launchers indefinitely on Minuteman facilities prior to attack and maintain the near 100% alert rate of the current ICBM force. We are confident we could sustain a viable dispersed force of small ICBMs for as long as necessary through resupply of consumables and replacement of critical parts obtained from prepositioned spares and/or cannibilization. With adequate support and planning, the small ICBM could provide a survivable capability throughout the trans- and post-attack period.

SUSTAINING STRATEGIC SUBMARINES AND BOMBERS ON ALERT

Senator THURMOND. How would you compare our ability to sustain strategic submarines and bombers in the same circumstances of extended alert?

General CHAIN. The sustainability of our strategic forces on extened alert is, of course, dependent on the crisis scenario. [Deleted.]

PLANNING FOR BOMBER AND SUBMARINE FORCES ON PEACETIME ALERT

Senator THURMOND. With the deemphasis on planning for [deleted] are we likely to see a similar deemphasis on the percentage of [deleted].

General CHAIN. A [deleted] is the least likely of all scenarios for the initiation of a nuclear conflict. However unlikely though, we must continue to deter such an attack. [Deleted.] These forces provide the "insurance policy" that allows us to deploy the second 50 Peacekeeper in a manner that allows [deleted].

ICBM MODERNIZATION GROWTH CAPABILITIES

Senator THURMOND. Does the ICBM modernization program have inherent growth capabilities to deal with increasing threats, and what are those capabilities?

General CHAIN. Yes, the ICBM modernization program offers tremendous growth opportunities. Mobility provides the weapon system survivability essential to counter the growing threat imposed by improving Soviet missile accuracies. Rail garrison basing will [deleted] and generation of location uncertainty. This further complicates the Soviet war planners' already formidable task. We think it makes the Soviet targeting problem extremely difficult—perhaps insolvable.

The small ICBM has a range of basing options because of the inherent flexibility of the hard mobile launcher. [Deleted.]

We are pursuing advanced technology research programs involving earth penetrating weapons to attack deeply buried, superhard targets, maneuvering reentry vehicles (MaRVs) which could place a warhead on a target with better accuracy or

evade Soviet defensive systems, and penetration aids to address current threats and provide a hedge against possible abrogation of the ABM Treaty or establishment of a Soviet nation-wide defense. Both the Peacekeeper and small ICBM, at 37,000 pounds, have the flexibility to carry these advanced systems.

WARNING OF A SOVIET FIRST STRIKE

Senator THURMOND. Is tactical warning of a Soviet first attack available to Strategic Air Command forces dispersed on generated alert with the same confidence that it is available to forces on peacetime alert?

General CHAIN. [Deleted.]

DISPERSAL OF STRATEGIC FORCES

Senator THURMOND. Once strategic forces are dispersed on the basis of strategic warning, what indicators would you need as an operational commander to indicate that more or less dispersal is required?

General CHAIN. The indicators I would rely upon to determine whether more or less dispersal is required are essentially the same indicators I would use in the initial decision to disperse our strategic forces. I would pay particular attention to those indicators which reflect the status of the opponent's strategic forces—the Soviet triad—and gauge my actions accordingly.

PLANS TO RETIRE B-52GS

Senator THURMOND. Are there plans to retire some B-52Gs in the current 5-Year Defense Plan earlier than was the case in last year's 5-year plan and, if so, what are your views of this change?

General CHAIN. Beginning in fiscal year 1990 the current 5-Year Defense Plan (FYDP) retires 110 (or 66% of the 'G' fleet) B-52Gs versus last year's FYDP which retired none. The timing of these retirements is based on an analysis of SIOP utility, the ongoing program to modernize our bomber force and budget considerations. However, these B-52Gs still have a tremendous military potential as a integral element of a worldwide conventional power projection force. For the aircraft remaining in the inventory, we have funded modifications to improve reliability and maintainability as well as add new capability. Further, these modified B-52Gs have sufficient service life to support the conventional mission for many years. The theater CINCs need this capability, SAC's B-52G fleet is bought and paid for, and retiring this tremendous capability does not make sense from a warfighter's point of view. I strongly support retaining these aircraft for conventional operations.

Senator LEVIN. Thank you.

[Whereupon, at 11:55 a.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, MARCH 19, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC
FORCES AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SELECTED BOMBER AND TANKER ISSUES

The subcommittee met in executive session, pursuant to notice, at 1:08 p.m. in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Bingaman, Glenn, and Thurmond.

Staff present: Arnold L. Punaro, staff director; Robert F. Bott, William E. Hoehn, Jr., Ronald P. Kelly, professional staff members; and Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Milton D. Beach, assistant to Senator Glenn; William J. Wight, assistant to Senator Warner; and James M. Bodner, assistant to Senator Cohen.

OPENING STATEMENT BY SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The committee will come to order. The Subcommittee on Strategic Forces and Nuclear Deterrence meets this afternoon for its 11th scheduled hearing. Our briefing this afternoon is from Gen. Mike Loh, the Director of Operational Requirements for the Air Force. We welcome you, General Loh.

General Loh will be briefing the subcommittee on several programs in the air-breathing, or bomber, leg of our triad. The two major issues that he will cover in some detail are: first, the rate at which we should fund the upgrading of our aerial tanker force, the KC-135A and the KC-135R configuration; and second, the SRAM II issue.

Each modified KC-135R tanker is from one and one half to two times as capable as the KC-135A. General Chain told us in his earlier appearances he is short of tankers and the shortfall is getting worse as both tactical and strategic force structures are increasing. General Chain also indicated that if additional funds were available his next dollar would go to the increase in the rate at which we modify our tankers.

That statement more than anything else, I think, signifies just how serious the potential problem is for the leadership of our Air Force.

This subcommittee has also been strongly supportive of the KC-135R program. We have increased the rate in each of the past 2 years, finally getting it to 50 last year. However, the Air Force request for fiscal years 1988 and 1989 has dropped the rate back to only 36 per year. The contractor has made a multi-year proposal to the Air Force, one that would cover all the rest of the tankers to be modified.

While it is by no means clear that we can afford the up-front costs to do that, I wanted this option to be presented to the subcommittee.

The SRAM II issue is one which this committee has addressed for several years. In the fiscal year 1986 Authorization Act, we asked for a study of alternatives, but received a wholly inadequate report which simply rules out all alternatives but the SRAM II.

In last year's Authorization Act, we repeated the requirement for the study of alternatives, which the Air Force and DOD are now performing. I hope it will be adequate to our needs, and I hope also that it will be delivered to us prior to markup. Otherwise, we may have no basis on which to authorize fiscal year 1988 and 1989 funds for the SRAM II program.

I understand General Loh will also touch very briefly at least on a couple of other issues. But before I invite General Loh to proceed, let me call upon my close friend, companion, and working associate, and a man that I admire very much— he told me to put that in.

My friend Senator Strom Thurmond, who has been working diligently for many, many years for the national security interest of the United States.

Senator THURMOND. Thank you very much for your kind remarks, Mr. Chairman. And I want to join you in welcoming General Loh to the subcommittee this afternoon, and congratulate you for holding this hearing.

Now, I have got to leave to go to an antitrust meeting, but I will be briefed on it later.

This subcommittee has already spent considerable time reviewing other aspects of the bomber program, including the B-1B, the Advanced Technology Bomber, and the Advanced Cruise Missile. In examining the short-range attack missile this afternoon, we will be addressing a critical weapons system that complements the effectiveness of our strategic bombers.

A number of important questions about this system have been raised in both houses of Congress in recent years, and I hope today's testimony begins the dialogue in response to questions raised in the fiscal year 1986 Defense Authorization Act.

Mr. Chairman, much discussion surrounds the share of the defense budget that is allocated to the strategic programs in contrast to conventional force spending. In recent years, the strategic share has been less than 15 percent, and this figure includes not only the strategic modernization program, but the direct cost of operating our existing strategic forces.

I believe it is worth noteing that a significant percentage of stratgic funding in fact supports our conventional force posture as well.

This is surely the case with our strategic bomber forces, which have a conventional role. This is the case with many of our strategic communications satellites, which also support other forces. It is also the case with our tanker forces, which while they are charged to strategic forces, are an essential part of our tactical air and military airlift posture.

We will be hearing about the tanker re-engining program this afternoon, and we might want to consider restoring this program to the levels anticipated in last year's budget in view of the importance of tanker support to our overall defense posture.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond.

Senator THURMOND. I will get back as soon as I can. I am chairing a committee over in Judiciary.

Senator EXON. We are doing an awful lot of double duty these days.

General, if you would please proceed.

STATEMENT OF MAJ. GEN. MICHAEL LOH, USAF, DIRECTOR OF OPERATIONAL REQUIREMENTS, DCS/R&D, HEADQUARTERS, USAF

General LOH. Thank you, Mr. Chairman. Thank you, Senator Thurmond.

I certainly appreciate the opportunity to appear before the committee today. This is my first appearance before this particular subcommittee and I sincerely appreciate the opportunity to be here and discuss three of our strategic programs that are vitally important ot us.

As you said, I would like to cover first the KC–135R re-engining program, and then move into the SRAM II program at some length. And with your permission, I would like also to discuss our B–52 modification program.

Senator EXON. Yes, we would like to hear about that, because that is one thing that comes along each and every year, usually about the time of the conference with the House of Representatives. The telephone starts ringing from SAC headquarters, and I appreciate being brought up to date on that.

General LOH. First, I do have a short statement, Mr. Chairman, that I would like to submit for the record, if you will.

Senator EXON. Without objection, we are pleased to accept it and it will be inserted in the record.

KC–135R MODERNIZATION PROGRAM

General LOH. I would like first to talk about the re-engining program, which is vitally important to us. The KC–135R modernization program without a doubt is the most cost-effective method of reducing our wartime tanker shortfall, since each KC–135R, as you pointed out, is worth at least—and I underscore, at least—1.5 KC–135A aircraft.

I want to assure you, Mr. Chairman, that the Air Force is firmly committed to the upgrade to the R configuration of each one of our 639 KC-135 aircraft, to that configuration, to help meet our wartime needs for strategic and conventional air refueling, as well as to support our specific long-range surgical strikes, such as occurred earlier this year, in support of our national security objectives.

As you mentioned, the 1987 budget provided for the procurement of 50 KC-135R aircraft modification kits per year, with the last procurement occurring about fiscal year 1996. I want to discuss this with you, sir, but due to purely fiscal constraints during our deliberations leading to the submission of the fiscal year 1988 and 1989 budgets, we were forced to lower our per year kits from 50 to 36.

I have one chart I would like to put up on the KC-135R that illustrates this, and if you will put that one up.

KC-135R MODERNIZATION PROGRAM

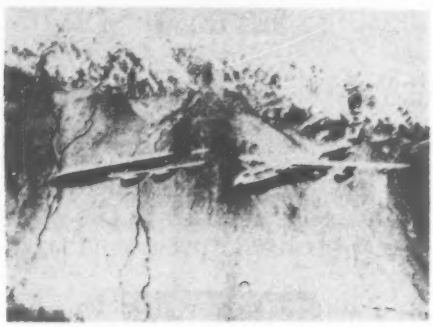
($ IN MILLIONS)

	FY 87	FY 88	FY 89	FY 90 - FY 92	TOTAL THROUGH FY92
MODIFICATION PROC	739.5	579.2	570.8*	1837.6	6215
QUANTITY	50	36	36	108	375

FY88
MODIFICATION REQUEST

$ 579.2

- AIRFRAME KITS 191.5
- ENGINE KITS 382.7
- TECHNICAL DATA 2.0
- SUPPORT EQUIP 3.0



- ALL 639 KC-135 AIRCRAFT WILL BE MODIFIED
- 375 PROCURED THROUGH FYDP - 264 REMAIN
- LAST PROCUREMENT FY 2000 AT 36 RATE

*NOTE FY89 UNDERFUNDED BY 19.5 - DISCONNECT WORKING

You funded 50 kits in fiscal year 1987 at a cost of just under $800 million. And as we were deliberating the fiscal year 1988 and 1989 budgets, we wanted to continue at the 50 per year rate.

However, as you are well aware, given the budget reductions we were forced to make between 1987 and 1988–1989, we in the Air Force had to take some fairly draconian measures. One of the measures that we regrettably were forced to take was to lower the quantity of KC-135R kits from 50 in 1988 and 1989 and the remainder of the 5-year period down to 36 each year.

And that was purely to get within the fiscal bogey that we were allocated within the Air Force, and not because we have in any way diminished our enthusiasm for or commitment to the KC-135R program.

As you see, we have 36 in the 1988 budget, we have 36 in the 1989 budget, although that right today is underfunded by about $19 million, and we are working that in our current budget exercise in the Pentagon to restore that minor shortfall in 1989.

Senator EXON. Wait a minute. So if I understand you, you are saying that you are $19 million short of even the 36?

General LOH. At the present time, yes, sir. In the 1989 budget, if we were to live within the funding that you see on the chart, that would probably not buy 36 aircraft, maybe 35, perhaps 34. Our intention is to buy 36, and our intention is to restore the funding that will allow us to do that.

Clearly, we would like to procure more modifications kits each year, because that will allow us to restore our shortfall in airlift earlier and it would allow us to complete the modification of all 639 aircraft in a more timely fashion than at 36 a year.

But unfortunately, we are forced to maintain only a 36 per year rate at this time. What I would like to underscore Mr. Chariman, is that we are firmly committed to the program. I have flown in the KC-135R. It is a world of difference between the KC-135A, not only in terms of the offload capability, but all of the other operational features that accompany the modification that are not often mentioned in the context of its refueling capability.

It is quite a different aircraft from the KC-135A, and we are solidly behind the program all the way.

Sir, if there are any questions on that, I could field them now. Or if not, I would like to move into the SRAM II program.

Senator EXON. I think it would be best if we finish up on the tanker if that is all right with you. Do you think that would be best, General?

General LOH. I beg your pardon?

Senator EXON. You do not have any objection to disposing of that?

General LOH. No, sir.

Senator EXON. I was first curious, how did you come up with 36? Was that the number you could fund rather than 50 with your allocation? Or was there some other formula that you went to?

General LOH. We looked at various options. We looked at some lower than 36 and we looked at some between 36 and 50, and it was our determination that, on the one hand, we wanted to achieve production rate efficiencies as best we could, and on the other hand, live within affordable budgets. And we decided that the level of 36 was the minimum we could go to and still retain fairly good production efficiencies, rate efficiencies, and we were unable to go below that regardless of the budget.

And so it was a combination of the dollars available and maintaining a fairly decent level of production rate efficiencies on the production line.

Senator EXON. Let me ask you this question so that I maybe can get a grasp of this. Would the cost rates be significantly different if we reprogrammed and modernized 30 instead of 36?

And likewise, would there be a significant difference if we went up to 40?

General LOH. Sir, there would be a significant difference in the unit cost if we lowered the units below 36.

Senator EXON. We thought that 36 was as far as you dared go, based upon the cost rising dramatically if you went below that?

General LOH. That is absolutely correct, sir.

Senator EXON. Therefore, if we start pruning around here, I guess what you are saying is, please do not prune that, because if you would cut that from 36 it would be very expensive. Is that correct?

General LOH. That is absolutely correct, sir. We have already done the pruning in going from 50 to 36, and if we lower the number below 36, one, it would take a lot longer to equip the entire fleet, and two, we get into unit cost increases that we would not want to stand.

Senator EXON. Do you have the figures? How much would we save on a multi-year contract of 50 per year, which was the plan, compared to your new figure 36?

How much is the difference?

General LOH. Sir, we have looked at those numbers. If we were able to work a multi-year procurement at the rate of 50 a year, our figures show that the savings over this current profile of 36 a year would be on the order of $965 million today.

The problem that we faced when we looked at that option, clearly a desirable option from the purely economical standpoint, is that we would have to increase the 50 1988 and 1989 number significantly to buy the up-front economic order quantities to get into that multi-year procurement. That is the dilemma that we always face in multi-year procurements. But in this particular case, it was particularly troublesome for us in that we could not generate support within the Department for a multi-year procurement because of the up-front cost.

Senator EXON. We would like to have the figures for the record. If you do not have it, please submit it, that if we directed you to go back up to the 50, how much more money would we need in fiscal 1988, in fiscal 1989. Do you have that?

General LOH. Sir, I can give you those figures right now, but not on a multi-year basis. On an annual funding basis, to go from the current rate of 36 per year to 50 a year in fiscal year 1988 would cost $164 million in addition to what we have in the budget, and in fiscal 1989 to go from 36 to 50 per year would add $193 million to the 1989 figure you see in the budget on an annual basis.

Senator EXON. It is rather interesting, General Loh, that as we go through this every day—and we went through this morning on some other aircraft in the Navy program—this is a pretty dramatic statistic to back up the concern that many of us have had for a long time with regard to our stretch-out of these programs and how much more it costs us and how much it drives the defense budget up.

That is one reason why there is considerable support here for a 2-year budget cycle. It would force us to look a little bit further down the road in the Department of Defense and maybe get into some savings.

Senator Glenn has joined us. We are about ready to go into the SRAM's. He may have some questions on the tanker. When it comes to airplanes, I have never been in a meeting with him when

he did not have some questions. And so I am glad to recognize Senator Glenn.

Senator GLENN. Well, I just would echo what Jim said. I am very concerned about this. We are involved with new programs such as ATF and ATB, and it does us blessed little good to have all of those programs unless we have the service stations to go along with them.

You do not have the mobility you need unless you have the tankers to do the job that has to be done, and the fleet is getting pretty old and used up.

I personally would prefer not to cut into our current mobility plan. If you do not have mobility, all the rest of the materiel in the world does not do you any good. It is all going to be useless.

The tanker is not as sexy as an ATF with forward-swept wings. But if you ever have to shuffle large numbers of airplanes around the world, you better have them immediately available, or it does not matter what you procure. And so I am all for putting in place some sort of program here to help you.

General LOH. Sir, I could not agree more.

Senator GLENN. Did this get whacked away at the Pentagon or at OMB?

General LOH. Sir, we did it, but purely because of affordability reasons. In the near term, we were forced to come in under some very draconian budgets. And we are solidly behind this program all the way, to the modification of every one of our tankers.

But we were forced to take a cut in the unit buy each year, purely for affordability reasons. And it does not represent in any way a diminishment of our enthusiasm for the support for the total program.

Senator GLENN. I was just trying to get an idea of whether you really had gotten through over there and they whacked it at OMB or vice versa?

General LOH. No, sir, we were forced to do that internally.

Senator GLENN. They did not cut you any more at OMB?

General LOH. No, sir.

And I would again like to reiterate that we think the bottom line number is 36. If we go below 36, we really get into some severe cost problems.

Senator EXON. Thank you.

I think then we will go to the SRAM. And for my colleague, I would just say that we have just been advised that there is a live quorum on the Contra aid situation, and we are going to have to go over and vote. But I suggest that we move right to the SRAM now, and at some appropriate time maybe we can trade off and go over and vote.

Would you please continue.

General LOH. Thank you, sir.

SRAM II

Sir, moving to the SRAM II, just a couple of introductory comments. The SRAM II, of course, is a major element of the President's strategic modernization program. It was established, as you know, to provide a safe and reliable replacement for the existing

SRAM missile. The program exists in its current form because of several events that have occurred over the history of the current SRAM-A program, particularly [deleted].

And in addition, as you are aware, some warhead safety problems and issues that we were forced to step up to. As a result, modification of the existing SRAM-A in our view has not been deemed to be cost effective and a replacement SRAM is the best solution, using our existing technology to minimize the risk and shorten the acquisition cycle.

SHORT RANGE ATTACK MISSILE II
(SRAM II)
• REPLACES AGING SHORT RANGE ATTACK MISSILE (SRAM)
• IMPROVES BOMBER UTILITY AND FLEXIBILITY ACROSS THE ENTIRE TARGET BASE
• PROVIDES PENETRATING BOMBERS WITH AIR TO GROUND PRIMARY STRIKE AND DEFENSE SUPPRESSION CAPABILITY
• FY 88 CONTINUES FULL SCALE DEVELOPMENT COMPLETES MISSILE DESIGN

WHY SRAM II Now

- Dwindling inventory.
- SRAM A—well beyond 10 year design service life.
  Last SRAM built in 1974.
  Increasing number of aging indications.
- Warhead safety.
- SRAM A—only warhead in bomber inventory that does not have modern safety/surety features.
- Reliability/maintainability problems.

Now, getting to your point about the report, we do have the point on the remotor of the SRAM and the warhead issue, that currently sits in the office of OSD. But we are churning to get that report to you and it should be here before you mark. We will ensure that we will do everything within our power to get you the report before the mark, and therefore within the next couple of weeks.

You are all well aware of the aging motor problem and the anomalies we have seen. But I would like to underscore what to us is an equally important deficiency of the existing SRAM-A missile, and that is the dwindling inventory and the reduction in the inven-

tory that we will see if we are forced to commit ourselves to live with the remotored SRAM-A for the next 15 to 20 years.

At the present time we are down to the order of [deleted] SRAM missiles. We will be using about 34 to 36 of those missiles during the flight testing of the B-1 [deleted] and that will leave us with about [deleted] or so. Over the next—if we were to live with the SRAM-A, over the next 10 to 15 years we would then be losing a large quantity for operational testing and reliability and as spares.

And that total quantity of existing SRAM-As could support an operational quantity of [deleted] SRAM missiles, short-range missiles, against a requirement that we see of [deleted] SRAM missiles. So for that reason, as well as the [deleted] that we have talked about and the warhead safety issue, the fact that we are reducing quantities of this very important missile is as important to us to get a SRAM II missile in the quantity of [deleted] which we have requested, which we consider to be a minimum number to support our force structure requirements for the short range missile into—for the next [deleted].

And I would want to underscore that quantity issue as part of the rationale for supporting the SRAM II and not electing to remotor the SRAM-A.

In addition, of course, you are aware that we have some warhead safety issues. The warhead for the SRAM-A and its associated safety equipment was built for the 1960's safety criteria. In the intervening 20 years, that criteria for the handling and the safety of nuclear weapons has increased considerably and we would want to, if we were to remotor the SRAM-A, we would at the same time need to update the safety criteria of the warhead, particularly to put in the insensitive high explosive requirements that exist today, as well as the electrical safety improvements that are required by the Department of Energy for the safe handling of nuclear weapons.

In addition, I will talk to the reliability and maintainability problems in a minute.

The next chart, please.

REMOTOR SRAM-A vs SRAM II

- Congress directed cost effectiveness study.
- Remotored SRAM feasible but must also replace/modify warhead.
- Remotored SRAM 20 years old at IOC.
  Service life limited by other missile subsystems (avionics, flight controls, etc).
  Expect 20 year service life for SRAM replacement.

The study that I mentioned a few minutes ago will be coming to you shortly. I would like to show a chart on the next chart that shows the cost difference between a remotored SRAM-A and the SRAM II that will be a part of that report.

But before I do so, I would also like to remind the committee that, were we to remotor the SRAM-A, the SRAM would be 20 years old at its initial operational capability, and then [deleted] years old as we would continue to try and support it through its service life.

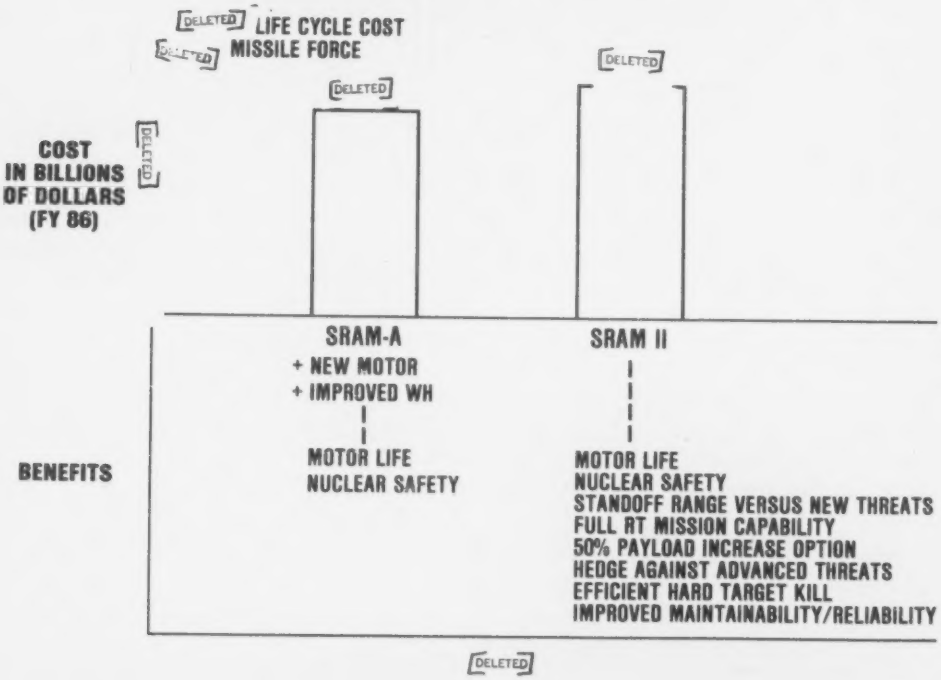
We see that, while it could have a new motor and upgraded safety criteria, the service life would then be limited by other missile subsystems, particularly by its 1960 vintage avionics and its

older flight control system and some other components, like the avionics or flight controls, would then be the limiting part of the weapon that would force us to pay more and more attention to in-commission rate and serviceability problems that we would inevitably have.

On the other hand, with the SRAM II system we will have a missile with all new components that will provide a robust operational capability, highly reliable, warranted for its reliability for a long period of time. And we would expect to be able to keep that for at least 15 to 20 years in the inventory at high operational rates.

[DELETED]

COST/BENEFIT COMPARISON (U)



On the next chart, Mr. Chairman, we show from the report that you will be seeing a chart that shows a life cycle cost comparison of the SRAM-A and SRAM II. Now, in the column labeled SRAM-A you will see that we have provided for a new motor. We have also provided for the improved warhead, improvements that are required by the DOE for nuclear safety, because we consider that to be an important addition, too, were we to remotor the SRAM-A.

And in the other column, the second column, you see the [deleted] life cycle cost of a new SRAM II, both columns representing [deleted] missiles because we only have—we would only have, if we remotored the SRAM-A, approximately [deleted] missiles in the inventory, although we have an inventory requirement for [deleted].

But to get an apples and apples comparison of the life cycle costs, we normalized that number to a [deleted] missile force. And as you can see by the size of the vertical chart, the difference between the

remotored SRAM-A and the new SRAM II is on the order of 15 percent, only 15 percent in total life cycle cost.

[Deleted.]

We also will achieve a much higher accuracy with the SRAM II than SRAM-A and, as we look at the threat base that we would apply the SRAM missiles against in the future, the two characteristics of increased hardening and increased mobility are of great concern to us. The SRAM II addresses those two changing target characteristics very well.

In the case of the increasingly hardened target base, the SRAM II provides for almost a three to one advantage in accuracy which is vital to attacking those harder targets. [Deleted.]

Senator EXON. General, my good friend John Glenn has just returned. I want to go and vote and then I will return. We are sorry to run in and out on you, but we are in one of those push and pull zones.

General LOH. I appreciate that, sir.

Senator GLENN. Why do you not proceed?

General LOH. Senator Glenn, I was just getting into the major issue of whether we should remotor the SRAM-A or proceed with the SRAM II missile and trying to highlight some of the rationale that we have looked at, particularly most recently over the past year in conjunction with the study that we will be providing to you within the next couple of weeks on this issue.

And of course, in addition to the increased capability that we have with the SRAM II, we see that it is particularly appropriate to employ against the harder Soviet target set that we see within the next 15 to 20 years, and [deleted].

Finally, the other very important reason that we feel the SRAM II is more important to us and more meaningful to us than a remotored SRAM-A is the business of reliability and maintainability.

RELIABILITY/MAINTAINABILITY

SRAM A

[Deleted] avionic failure rate during periodic testing.
Avionic failure rate expected to increase with 20 more years of storage.
SRAM maintained by cannibalization.
Spares inventory extremely limited/nonexistent.
Some spares cannot be procured.
Obsolete technology.
Limited production run.

We continue to experience high avionics failure rates with the SRAM-A, and during periodic testing that failure rate has been [deleted].

We do that by a lot of activity, manpower intensive, including cannibalization of parts from malfunctioning missiles in order to make an adequate number of the SRAM-As operational. And that is increasingly difficult because our spares inventories continue to be limited or nonexistent, because they are based on the 1960's avionics technology and it is becoming more difficult for us to achieve those spares with a more limited vendor base that we see today.

All of this would be greatly aggravated and exacerbated were we to be forced to live with the SRAM-A system over the next [deleted] years, and I cannot overemphasize this point. We, as I said,

have a limited number of SRAM-As right now. As the operational ready rate of those SRAMs decreases because of these reliability problems, we feel that will force a major reduction in our readiness in this vital component of our strategic force, that of short range attack missiles.

Senator GLENN. When you talk about [deleted] or so, have you identified the end of service life date for the SRAM-A?

General LOH. Sir, we had initially. Of course, when the SRAM-A came into existence, it had a 5-year service life. We have now been keeping the SRAM-A for 15 years. The last one was delivered in 1974, and so we consider that today the SRAM-A has outlived its service life.

That is particularly true of the rocket motor, of course, and that is one of the issues that we address or that we have addressed.

Senator GLENN. Okay. But for instance, how far can you extend it still? Maybe it was supposed to be for 5 years, but it has gone 15. Will it go another 15?

General LOH. Sir, we do not believe so. In fact, the anomalies that we see today in the rocket motor, the increasing pressure spikes that we see when we fire operational SRAM-A missiles [deleted].

Senator GLENN. That is the data I would like to have. Do you have an estimate on when the whole thing is going to become nonoperational?

General LOH. Sir, we think that could occur at any time within the next few years.

Senator GLENN. How do you monitor this? Are you just monitoring the rocket grain?

General LOH. Because we are firing four SRAM-As a year in testing, we instrument them and measure the burn rate and the burn characteristics. And in every one of the four firings that we have fired since we appeared before you last year, each one of those has indicated symptoms of anomalies in the burn of the rocket motor.

The most prevalent symptom is that it arrives at its target early in time, which indicates that it is getting a higher pressure spike in the rocket burn, which is indicative of this problem.

Senator GLENN. Let me follow up. If you extrapolate the pressure rise you are seeing in these four tests per year, how far out does it go? Does it go out to the turn of the century? When does it get to the danger point?

General LOH. Sir, we are not seeing any worsening trend. We see various anomalies, some worse than others, and so we cannot predict by a trend when it would hit a catastrophic level. But we are afraid that at any point in time we will reach an explosion, not just a pressurized but an explosion in the rocket motor.

Senator GLENN. Well, let us say the trend is getting worse. If you just extrapolate a straight line data right now, where do they become dangerous?

General LOH. I will have to get that for you, Senator Glenn. I do not have that data with me.

[The information follows:]

SRAM–A TRENDS

The Air Force has conducted surveillance testing on SRAM–A motors since 1973. The purpose of surveillance testing is to determine the health of the rocket motors. This testing consists of static firings and motor dissections. Nine ballistic parameters are monitored and statistical analyses are performed. The results of these analyses permit us to project a motor service life only 2 years beyond the current age of the oldest rocket motor. The latest test data indicates that 90% of each ballistic parameter population is expected to be within specification limits (with 90% confidence) at the service life extension which is approximately 14 years. In other words, the Air Force can predict with some assurance that motors are good through 1988 (14 years beyond the date of the oldest motor.)

Extrapolations of motor pressure over time indicate that maximum pressure will exceed specification limits after 18 to 26 years of age depending on the assumptions made in the calculations. While extrapolations predict the possibility of an extended service life, there is a great deal of concern regarding fleetwide, catastrophic failure of the motors.

SRAM motors have exploded during flight testing. These particular motors were not the oldest ones in the inventory. Because each motor was hand built, a direct relationship between age and likelihood of failure is not always valid. Also, the phenomena of aging in a rocket motor the size and complexity of SRAM–A are not well understood by the technical community.

Because ageout predictions are a "black art," motor anomalies are present during operational flight testing and lead time for a replacement system exceeds 5 years, we believe the best decision is to proceed with the SRAM II program.

Senator GLENN. What I am searching for is, when does SRAM–A become unusable? You are saying you test four every year. You have had some pressure rises that give you problems, and you do not want to wait until they start blowing up before you do something about it.

And if you say this problem is not getting worse, it is not a curve but a straight line, then we should be able to estimate where this starts getting dangerous.

General LOH. Sir, I say we do not have full instrumentation on these missiles. We have seen this phenomenon over the past several years. The engineers tell us that, because of the shelf life of the rocket motor, it could turn into an explosive condition at any time. And so we are more concerned about a catastrophic, precipitous failure of the entire fleet of rocket motors than we are about a worsening trend.

Senator GLENN. Are you running into a change of the propellant itself, or are you running into cracks? There is a big difference.

General LOH. Sir, we have seen some migration of the propellant. We have not seen cracks in the rocket motor, but a general deterioration of the grain.

Senator GLENN. Well, cracks would worry me a lot more than the other. Once cracks start then you are in deep trouble.

Have you had any complete failures from the tests so far? Have you had any blow-ups?

General LOH. [Deleted.]

Senator GLENN. When did this occur?

General LOH. Sir, it was right after launch, within the first few seconds after launch.

Senator GLENN. Could you tell us what happened?

Did you have it instrumented enough to tell what the problem was?

General LOH. It was a pressure spike in the burn profile, sir.

Senator GLENN. But you do not know whether it was a general deterioration of the grain or cracks in the grain?

General LOH. Sir, we were unable to tell.

Senator GLENN. Go ahead.

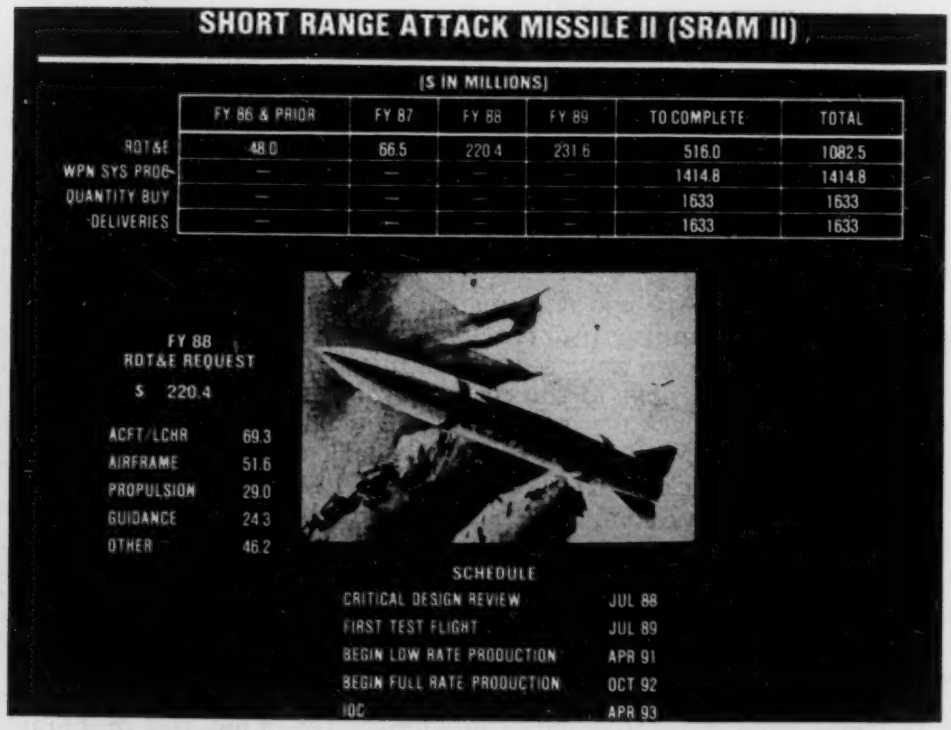
General LOH. Sir, after talking about all that bad news, I would like to close my portion of the SRAM II by talking about some good news.

CURRENT STATUS—SRAM II

Completed System Definition/Risk Reduction Program.
Completed source selection.
Boeing announced as winner—
    Saved $600M from fiscal year 1987 PB cost.
FSD contract award fiscal year 1987.

That is the SRAM II program we have on contract now with the Boeing Company to develop and produce the SRAM II missile. We, as you know, have just gone through a very intense competition for the SRAM II system, and we completed our source selection not long ago and selected Boeing as the winner of that competition. In conducting the competition itself, it was very fruitful for us because we have been able to identify over $600 million of cost savings, most of which we can attribute to competition in the program.

And from the dollars that we showed you in our fiscal year 1987 President's budget to the dollars that we show you in our 1988–1989 budget, you will see a reduction of some $600 million.



That is good news, and that has been driven, as I said, principally by competition. We competed not only the full-scale develop-

ment, but the first three production lots we had on contract with Boeing. We also have ensured that we have multiple competitive sources for the major subsystems of the SRAM II system, and when we aggregate the initial competition for the initial full-scale development and production, plus the multiple sources under competition for the remainder of the program, more than 85 percent of the dollars that we will expend for SRAM II are under competition.

And we attribute that cost reduction that we showed from last year to this year as directly attributable to that competition.

The program is on schedule. We will be entering full-scale development later on this year. And the overall risk in the SRAM II program we would classify as low to perhaps moderate in one or two subsystems, but overall low in terms of achieving a 1993 IOC that we show on the chart.

Our first flight will be in 1989, and we will have 24 missiles, I believe, for the flight test program leading to our initial capability.

Senator GLENN. What is the difference in the two programs of the SRAM-A and this as far as your [deleted]. Is this a substantial upgrade in that capability?

General LOH. [Deleted].

Therefore, there is a premium paid to the [deleted].

We have virtually no capability in the SRAM-A to do that. That is a major feature and a major characteristic of the SRAM II because of its much larger footprint.

Senator GLENN. Well, back up just a little bit. Let us go into a combat scenario. You are flying your airplane and we are trying to [deleted].

General LOH. [Deleted.] Combined with intelligence, that would become, through jam-resistant communications into the aircraft, to be able to do that.

Very limited capability today, there is no question about that. [Deleted.] And a SRAM II has a unique capability.

Senator GLENN. What is the range? Let us say I am going along in my B-1, and I see something up here. [Deleted.]

General LOH. [Deleted.] And that allows the crew of the B-1 [deleted] about 7 or 8 minutes to input the target location and launch the missile, which is more than adequate time, because you can do that within a few seconds or should be able to do that within a few seconds, or a minute.

Senator GLENN. Well, we do not know what the sensor is on this thing or how far off we are going to be with the sensor. How can we know what our range with the SRAM II is going to be?

General LOH. [Deleted.]

Senator GLENN. Does it have to stay illuminated?

General LOH. [Deleted.]

Senator GLENN. Is this a shoot and forget?

General LOH. Yes, sir, it is. There is no need to continue to track the target at all from the launch aircraft.

Senator GLENN. The Chairman is back now and I have to go to another hearing. I wish I could stay. This is very interesting.

The General has not completed his testimony yet.

Senator EXON. Thank you, Senator Glenn, very much. I appreciate it.

Go ahead. We have all kinds of problems, General. So if you could shorten things a little bit, we would appreciate it. We are going to have another roll call vote, and I am supposed to be in Budget, and there is a little matter called Agriculture coming up at the Budget Committee hearing that I have some interest in, as you can well imagine. So please proceed.

General LOH. Sir, I can finish in 30 seconds. I would just want to remind you that we have some good news on the SRAM II, and it is with our contract award to Boeing we have been able to reduce the cost of the program by over $600 million from the numbers that you were shown last year. And that has come about, we feel, directly because of the intense competition that we held for the program and the manner in which we have developed multiple sources for the subcontractors.

So we are on contract. We are going to be entering full-scale development here in a few months, leading to an initial capability in 1993. And we do not see any high risk elements in the SRAM II program that would prevent us from fielding that system on schedule.

Thank you, sir.

[The prepared statement of General Loh follows:]

PREPARED STATEMENT OF MAJ. GEN. JOHN M. LOH, DIRECTOR OF OPERATIONAL REQUIREMENTS, DCS/RESEARCH DEVLEOPMENT AND ACQUISITION, HEADQUARTERS, USAF

STRATEGIC AIRCRAFT PROGRAMS

Mr. Chairman and members of the committee: I appreciate the opportunity to appear before the committee today to discuss two Air Force strategic programs: The Short Range Attack Missile (SRAM II) and the KC-135R.

The current KC-135 force was procured in the late 1950s to support Strategic Air Command bombers in the SIOP role. In 1960 there were approximately 2,000 aircraft capable of being air refueled. Today, the number of aircraft requiring air refueling is over 13,000 and continuing to climb. The KC-135R modernization program is the most cost-effective method of reducing the wartime shortfall since each KC-135R is the equivalent of 1.5 KC-135A aircraft. The Air Force is firmly committed to the upgrade of this vital resource and intends to modify all 639 KC-135 aircraft to the "R" configuration to help meet the wartime needs for strategic and conventional air refueling as well as to support specific long-range surgical strikes such as the Libya strike mission. The fiscal year 1987 Defense budget provided for procurement of 50 KC-135R aircraft modification kits per year with the last procurement in fiscal year 1996. Due to purely fiscal constraints during the fiscal year 1988 Budget Estimate Submission, the Air Force was forced to reduce the procurement schedule to 36 kits per year for fiscal years 1988 and out. This profile results in the last modification kit being procured in fiscal year 2000 and completing installation in fiscal year 2002. The decrease in procurement from 50 to 36 kits per year deletes the equivalent of seven KC-135s each year with resultant exacerbation of the tanker shortfall. Although we had hoped to be able to modify the aircraft at a much faster rate, total obligation authority limitations forced the Air Force to make the hard decision to cut this program as well as several others of equal importance.

In the fall of 1986, the Office of the Secretary of Defense requested that the Air Force identify programs for consideration for multiyear procurement. The Air Staff requested and received multiyear procurement estimates from the Air Force Logistics Center program manager at Oklahoma City Air Logistics Center. The major contractors were requested to provide informal estimates of relative costs of multiyear and annual procurements for 50, 60, and 72 kits per year. In November 1986, the Air Force submitted the KC-135R Program to the Office of the Secretary of Defense as one of its candidates for multiyear procurement, however, the KC-135R submission stated that only procurement quantities of 50 kits or better would result in sufficient savings to make multiyear procurement attractive. Although the savings in a 50, 60, and 72 kit multiyear buy were significant compared to the current

program, the KC-135R program was not selected for multiyear procurement by the Joint Resources Management Board, largely because an effective multiyear profile would require a "plus-up" from 36 to 50 kits per year. Since the Air Force faces severe funding limitations and has taken such drastic actions as closing units and eliminating force structure, there is simply not enough money in the current budget to fund the 50 kit procurement.

SRAM II is a major element of the President's Strategic Modernization Program. SRAM II was established to provide a safe and reliable replacement for the existing SRAM. The program exists in its current form because of several events that have occurred over the history of the current SRAM: (i) difficulties in developing its motor; (ii) motor anomalies during operational testing indicative of age-related problems; (iii) unsuccessful attempts to correct these problems and extend its life; (iv) warhead safety issue. As a result, modification of the SRAM-A was not deemed cost effective. A replacement SRAM is the best solution using existing technology to minimize risk and shorten the acquisition cycle.

Technology has progressed since SRAM-A was designed in the late 1960s. At the same time, the Soviet threat has become more severe and projections into the next century show further improvements in depth and capability. When faced with the design of a replacement, the cost of a missile with precisely the same preformance capability of the current missile approaches that of one with increased performance. So, it is only prudent to include improvements in range, accuracy and speed, within the limits of acceptable cost, in the replacement missile to ensure its effectiveness well into the next century.

The fiscal year 1987 budget provided funds to begin full scale development of a SRAM replacement. Our fiscal year 1988 request will continue this activity. Design of the missile and the aircraft interface will be completed. Full scale testing of prototype hardware will begin and, upon successful completion of engineering reviews, fabrication of flight test missiles will begin. Flight testing begins in fiscal year 1989.

Mr. Chairman this concludes my remarks.

Senator EXON. General, thank you.

B-52

You have the B-52 mod that you wanted to talk about a little bit, and I am very much interested in that. We will go into that. I just have one other question in addition to what has already been asked you.

I would like to have you submit for the record some information before our markup for the savings from bringing about the tanker program at 50 per year, going back up to that, rather than the 36 that you would be restricted to because of the budget.

And I would like to have that information both with and without multi-year projections, and give us the increases that we would have to make in both 1988 and 1989 to get to the full 50 per year, as most of us on this committee were pretty much sold on.

So give us those both with and without multi-year, so that we have got some ways to go, because there is going to be a lot of give and take in that markup. And I am sure that the questions I am asking you are going to come up, and so if you could direct that back to us we would appreciate it, no later than April 4th.

General LOH. Sir, we would be delighted to provide that for the record.

[The information follows:]

KC-135R MODERNIZATION

Increasing the KC-135R annual procurement from 36 to 50 modification kits per year is estimated to cost approximately $164M additionally in fiscal year 1988 and $193M additionally in fiscal year 1989. A 50 kit annual procurement would result in estimated savings of approximately $900M from the current 36 kit buy over the total program and would complete procurement in fiscal year 1996 instead of fiscal year 2000.

A multiyear procurement could be advantageous to the Air Force in saving additional funds if the procurement were restored to the 50 kit level. Estimated savings of a 50 kit multi-year procurement over a 36 kit annual buy are approximately $965M with the potential to rise to $1.2B with favorable negotiations and stable interest rates. A 50 kit multi-year procurement could be initiated with no additional up-front costs beyond the funding increase required to restore the program to 50 kits annually.

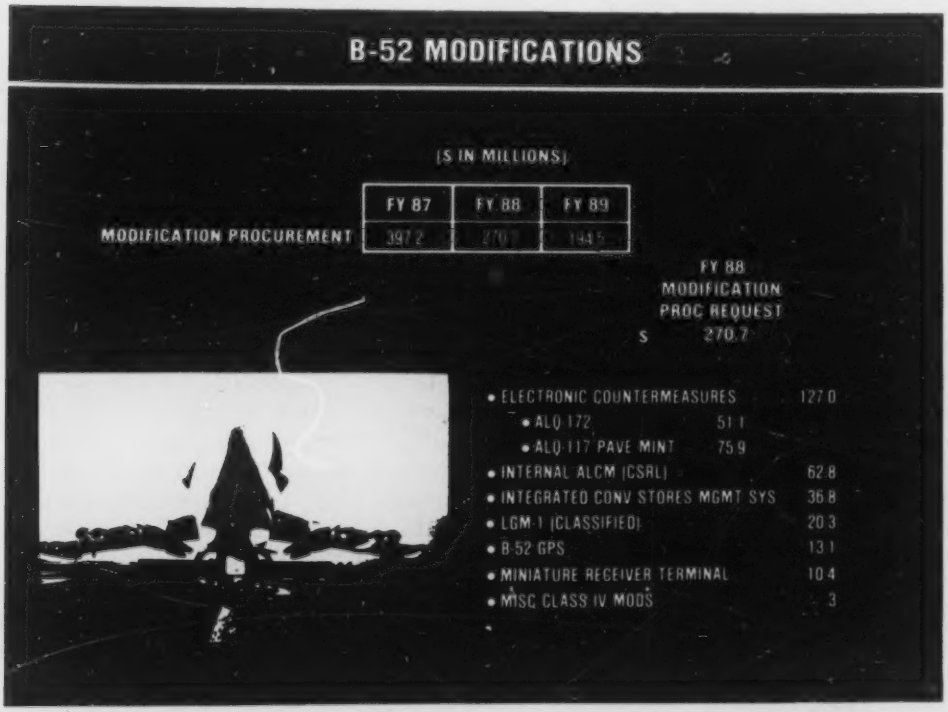
Senator EXON. Why do you not proceed with the B–52s.

General LOH. Sir, the last program I would like to talk to you about is our B–52 modification program. As General Chain may have mentioned to you when he appeared, the continued upgrade and use of our B–52 force is particularly important to us in the Air Force, and in particular I would like to stress the improvement in our conventional capability that comes about by the continued use of the B–52s and the non-ALCM B–52G force.

B–52 FISCAL YEAR 1987 FUNDING REQUEST

Fiscal year 1987 $142.4M appropriation/authorization shortfall.
Impacts B–52G conventional modification programs.
- Integrated conventional stores management system.
- Global positioning system.
- Strategic radar.
- ALQ–117 Pave mint sensor integration.

Conventional modernization is a high priority.



In order to sustain that capability with our B–52s, which we consider vital, both conventional and in support of the SIOP mission, we have a modification program under way that upgrades certain

features of the aircraft. Now, in fiscal year 1987 we were cut by some $142 million from our request for modifications.

That came at a particularly inappropriate time, because we were beginning to start on several modifications of the B–52 that were particularly important to us for its conventional capability, particularly the modifications of the aircraft that will allow us to employ smart stand-off munitions from the B–52G force, the introduction of the global positioning system on the aircraft, and the reliability improvements to the strategic radar that we feel are very important, as weil as some EW upgrades.

This $142 million shortfall that occurred in fiscal 1987 was a part of the appropriated but not authorized category of programs in that budget. And this particular shortfall was particularly damaging to us, and it is a part of Secretary Weinberger's most recent communication with the Congress regarding that category of programs that were appropriated and not authorized.

And we would seek your assistance in helping to restore those fiscal year 1987 dollars that will allow us to get on with the modification of the B–52s that we had in the 1987 budget. And of course, at the same time we seek your support for the continuation of those very important mods that are shown on this chart, and those are the fiscal 1988 and fiscal 1989 budgets, sir.

Senator EXON. Well, I cannot read all those figures from here. How far along with our B–52 fleet are we with the mods? Are we halfway home?

General LOH. Sir, with regard to the strategic radar, we were almost all the way home, and it was particularly painful that we did not get the 1987 dollars. We lacked only 61 kits for the conventional Gs to completely upgrade that radar, and that was a particularly tough one.

The ability to carry and launch smart standoff weapons was just beginning in 1986, and of course we need that capability because, as you know, early in the nineties we are going to be fielding those smart standoff weapons, and we need to launch them from B–52s.

So that modification that we were unable to continue in 1987 because of the cut was particularly damaging to us, and we would seek your support to begin that, with the restoral of those funds.

Senator EXON. Thank you, General.

With regard to the B–52s, has there been a change in the plan in the current 5 year defense plan for the retention of the B–52Gs?

General LOH. Sir, I can only talk to the 1988 and 1989 request. There hasn't been a change in the B–52G force in 1988 and 1989. And as you know and as General Chain has said many times, the retention of the B–52Gs is one of our goals, and we seek to retain all of the B–52Gs that we currently have.

There are, beyond 1989, discussions regarding the reduction of the number of B–52Gs in the force within the 5 year plan.

Senator EXON. For what reason? This is when the B–1Bs start coming on line? Is that the reason for that?

General LOH. Sir, I believe it is purely for supportability and again affordability reasons that some would seek to reduce the number of B–52Gs. But we in the Air Force strongly support——

Senator EXON. You mean some of those years beyond the next two?

General LOH. Yes, sir.

Senator EXON. Maybe you had best supply this for the record also.

And I hate to belabor you with all of this, but—well, maybe you know offhand how much money has gone into the B–52 mods, all of the mods for the B–52s since the last B–52 was delivered to SAC. Is that a big undertaking?

General LOH. No, sir, that is not a big undertaking. But I would respectfully ask that I could submit that for the record.

Senator EXON. That is what I would like to have you do. We appreciate that very much.

[The information follows:]

B–52 MODIFICATIONS

The last B–52 aircraft was delivered to SAC in 1962. The following costs reflect modification procurement funds obligated/to be obligated from 1955 through fiscal year 1987.

	Billions
Class V Mods	$4.064
Class IV Mods	1.386
Total	5.450

Senator EXON. I have no further questions, General. Is there anything that you would like to say in conclusion or in summary? You have given us a lot of very interesting information, and I would imagine that we are going to have a discussion on the authorization about those 50 tankers. I think that is of concern to us, and it obviously is of concern to you and General Chain.

So if you would please get the information back to us.

Is there anything more that you care to testify to this afternoon?

General LOH. No, sir. I have enjoyed appearing before you today and I thank you very much.

[Questions for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN GLENN

B–1B CONVENTIONAL WEAPONS TESTING

Senator GLENN. What is the status of B–1B conventional weapons testing and integration? When will the B–1B alert force have a conventional weapons capability? Will the B–1B have the capability to deliver all appropriate conventional weapons such as Harpoon and other "smart weapons?"

General LOH. B–1B conventional weapons testing is underway at Edwards AFB to support Strategic Air Command's conventional capability. Initial certification will be completed this year. All B/1s will initially be capable of carrying Mark–82 and Mark–36 conventional weapons. Procurement of conventional support equipment and construction of munition preload facilities are in progress at Ellsworth AFB.

Conventional aircrew training will begin later this year. The B–1B alert force does not sit conventional alert. However, based on current schedules, SAC plans to have a limited conventional capability available for Joint Chiefs of Staff tasking in December 1987.

Strategic Air Command is studying conventional capability upgrades to all of its manned bombers, but the baseline B–1B will only be certified with the Mark–82 and Mark–36.

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

B-52 MODIFICATIONS

Senator THURMOND. Would you characterize the majority of modifications that are planned for the B-52s to be in support of strategic nuclear or conventional missions?

General LOH. The fiscal year 1988 budget request includes seven B-52 modification programs. Four of these programs focus on the B-52H strategic nuclear mission and the remaining three programs support our B-52G conventional mission. This reflects a proportionate balance between the size of the B-52 fleets assigned to these respective missions. There are no programmed modifications for those B-52G ALCM aircraft which carry cruise missiles.

The four modification programs supporting our 96 B-52H aircraft and their strategic nuclear mission account for 56% of our budget request. These programs are designed to maintain the near term effectiveness of the B-52H as a penetrating bomber and continue its long term transition to a standoff cruise missile launcher. They include the ALQ-172 electronic countermeasures modification, the Common Strategic Rotary Launcher, [deleted] and addition of the Miniature Receiver Terminal.

The three programs supporting our 69 B-52G non-ALCM aircraft and their conventional mission account for 44% of our budget request. These programs are designed to improve the survivability and lethality of the B-52G conventional bomber. They include the ALQ-117 PAVE MINT electronic countermeasures modification, the Integrated Conventional Stores Managment System and the Global Positioning System. These last two programs will enable the B-52G to employ the new family of standoff precision guided munitions.

TANKER REQUIREMENTS

Senator THURMOND. Have there been changes in tanker requirements to warrant the change in procurement rate in the current budget request?

General LOH. Tanker requirements for SIOP and conventional forces have not changed, and a large tanker shortfall will continue to exist for the foreseeable future. In fact, as Air Force support for Navy carrier battle groups increases, the need for tankers will actually grow larger. To reduce the shortfall, the Air Force remains firmly and enthusiastically committed to the KC-135R modernization program. This program is the most cost effective and efficient way to increase the capability of our tanker force. Unfortunately, fiscal constraints have forced us to reduce KC-135R kit procurement from 50 kits in fiscal year 1987, to a budget request in fiscal year 1988 and fiscal year 1989 of 36 kits per year. This reduction in procurement rate does not indicate diminished support for the KC-135R program, but rather reflects the best balance between production efficiency and budget limitations.

SRAM REQUIREMENTS

Senator THURMOND. Last year, the case for a new Short Range Attack Missile was almost entirely threat and requirement driven. Is that likely to be the case in the report to the Congress now under preparation?

General LOH. Last year the Department of Defense was directed to prepare a study that justified the requirements for SRAM II and compared the performance of SRAM II with an "austere" version of the SRAM. This year's report compares the performance of SRAM II to modified versions of SRAM-A, addresses maintainability problems and nuclear safety concerns.

SRAM II is required for several reasons. First, SRAM-A is aging and is becoming more difficult to sustain; it will have been in the inventory 20 years at the projected IOC for SRAM II. The 10-year service life for SRAM-A (5-years for the motor) has already been exceeded. Over the past 4 years, each missile flight tested has arrived at the target early which is an indication of increasing motor pressure within the missile. The failure rate for a missile removed from storage is 35%; this rate will increase as the missile gets older. Spare parts inventory is limited, some parts can not be obtained due to obsolete technology or loss of suppliers. SRAM maintenance personnel must cannibalize components from other missiles to maintain operational requirements.

The second reason for SRAM II is to remove the existing SRAM warhead from the inventory. The existing warhead does not meet all nuclear safety design criteria

and lacks some of the modern electrical safety devices. The SRAM-A warhead is the only warhead remaining on aircraft alert without these improvements.

The third reason is because of the number of SRAM-A missiles available. The current inventory of SRAM-A missiles is inadequate to support our bomber modernization program. SRAM II provides a production source in response to strategic requirements.

Finally, SRAM II provides superior warfighting capability. SRAM II flies further, faster and is more accurate than SRAM-A. These improvements provide an important hedge against the uncertainty of the threat and target base beyond the turn of the century.

This year's report concludes that SRAM II is the most cost effective configuration for a SRAM replacement.

STRATEGIC AND TACTICAL BUDGET PRIORITIES

Senator THURMOND. What is the process used by the Air Force in determining the contribution of strategic bomber assets to meeting conventional force requirements? In other words, how does the Air Force trade off strategic bomber capabilities and tactical Air Force capabilities in arriving at budget priorities?

General LOH. Determination of strategic bomber conventional requirements involves matching aircraft capability with the target base. This is accomplished by the theater commanders who apply unique strategic bomber characteristics (long range, large payload) to specific target sets which are generally deep, area targets (e.g., railyards, POL facilities, supply depots, etc). Theater planners strike the target base with the most appropriate system (strategic, tactical). The theater commanders then submit their numerical requirements to the Joint Chiefs of Staff for consolidation.

Since Air Force strategic and tactical forces are significantly less than theater commanders need, there are no direct tradeoffs between strategic and tactical forces.

Senator EXON. General, thank you. It has been very informative. And we are adjourned.

[Whereupon, at 2:02 p.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

MONDAY, MARCH 23, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC
FORCES AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SELECTED CHEMICAL AND THEATER NUCLEAR WEAPONS ISSUES

The subcommittee met in executive session, pursuant to notice, at 3:04 p.m. in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Stennis, Levin, Warner, Thurmond, Humphrey, and Wilson.

Staff present: Carl M. Smith, staff director for the minority; Romie L. Brownlee, deputy minority staff director; Robert G. Bell; Robert F. Bott; William E. Hoehn, Jr.; Ronald P. Kelly, professional staff members; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Milton D. Beach, assistant to Senator Glenn; James M. Bodner, assistant to Senator Cohen; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT BY SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order, please.

The Subcommittee on Strategic Forces and Nuclear Deterrence meets today for the 12th scheduled hearing. Although the hearing announcement stated we would be covering both chemical and theater nuclear issues, as it turns out today's program will be devoted entirely to chemical weapons, defense, and demilitarization problems.

Our first witness is Hon. Robert Barker, who is the Assistant to the Secretary of Defense for Atomic Energy Matters. I note that his office is also responsible for oversight of chemical weapons issues as well.

We welcome you, Dr. Barker. I understand that you just returned from abroad this weekend, so we will try to move along quickly this afternoon. If you are like the rest of us after experiencing that, you probably have some jet lag, and if you lag a little bit

this afternoon we will understand because we have been through it.

Dr. Barker will discuss briefly the current status of the two new binary chemical weapons programs, the 155 millimeter artillery shell and the Bigeye bomb, and will review the compliance of these programs with existing laws.

Following this review, we will have a round of questions, and then move on to the next panel, Panel II, for which Dr. Barker will be joined by Hon. James Ambrose, the Under Secretary of the Army. They will cover two additional subjects, the competition for a new chemical agent protective mask for the troops, and the issue of demilitarization of the existing stockpile of older chemical agents and weapons.

I will call then for Dr. Barker to begin. Would you be good enough to introduce the other witnesses that you have brought with you this morning? We are delighted to have all of you.

Senator Thurmond will be joining us in just a moment and, at an appropriate time, I will ask Senator Thurmond for any opening remarks that he has that would be of help to you in answering questions, and also for the information of ourselves and others who will be reading this record.

And just as I have said those nice things about my good friend and colleague from South Carolina, he walked in the door. You should have been here to hear all the good things I said about you, but you will be able to read them in the record.

Senator THURMOND. I surely will.

Senator EXON. I would call on the Senator.

Are the microphones on?

Mr. SMITH. No.

Senator EXON. They are not on. It is a closed hearing, and the microphones will not be used.

Senator THURMOND. And you have made your statement?

Senator EXON. I have made my statement. It is up to you, Senator.

Senator THURMOND. Thank you, Mr. Chairman.

I want to congratulate you, Mr. Chairman, for this hearing this afternoon and join you in welcoming our guests, our witnesses. The chemical weapons program is one in which this committee has had a long-standing interest, and one which I am pleased to note is beginning to bear fruit. This is the first year in some time when a hearing on the issue of chemical weapons modernization will be focusing on the progress made to modernize our chemical deterrent rather than on the issue of whether to proceed with modernization.

Dr. Barker, I want to congratulate you for the timely submission of a very excellent written statement. I look forward to hearing your testimony.

One issue of considerable interest to me is the progress being made to implement the chemical deterrent production program in view of legislative provisions enacted over the past few years. With respect to the fiscal year 1987 Defense Authorization Act, it was not the intent of the Conferees to impede the program with the certification requirements that were enacted into law. I would be interested to learn if the law is being interpreted in a manner that is creating an impediment.

I want to say that for many years I have favored going forward with the chemical weapons program. In World War II—and I happened to have been in that war—the Germans did not use chemicals because we had them. Had we not had chemicals, I think they would have used them. If we should have a war with the Soviet Union, they have chemicals. I think they will not use chemicals if we have chemicals. If not, I think they probably would.

So it is absolutely essential, in my judgment, that we go forward with chemical weapons.

Thank you very much, Mr. Chairman.

Senator EXON. Thank you.

Before the witnesses start, I would like to call on the former chairman of the Armed Services Committee, Senator John Stennis, a very distinguished member of this committee, who now heads the Appropriations Committee. He has always played such a key role in all of these defense matters. I am delighted to welcome my friend to our subcommittee this afternoon, and would invite him to make any statement he would care to at this time.

Senator STENNIS. I thank you very much, Mr. Chairman. I have come here because of my interest. I have been here with you two gentlemen a long time, and remember the first day when you got here. Senator Thurmond and I go back to the old days of our ROTC together.

Thank you very much. I am glad to be here.

Senator EXON. Thank you. I guess this is the first subcommittee I have ever chaired, and it probably does not happen to too many individuals, but I have the President pro tempore of the Senate sitting on my right, and the immediate past President pro tempore of the Senate on my left, and if I can ever learn as much as they know collectively about national defense, I will be pleased indeed. If I could ever learn half as much. So I look up to them very much, and I follow their guidance.

I would say, just as an aside, that I do not follow their recommendations, nor that of their States, on either football or basketball.

I would point out that Senator Stennis' team, Southern Mississippi, is about to play Nebraska tomorrow night in New York in one of the final four up at that tournament. I wish you all the luck in the world within reason for that contest.

Right now, then, we will move ahead with our business.

Senator THURMOND. I might say, Mr. Chairman, that Clemson happened to play Nebraska a few years ago and won the national championship, but we realize Nebraska has a wonderful team every year, but we hope to get to play again.

Senator EXON. We are looking forward to that, also.

Mr. Secretary, your statement, as of now, without objection will be made a part of the record. I believe we will proceed then in the usual manner to summarize, and again if you would, please introduce the people that you brought with you today.

STATEMENT OF HON. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE [ATOMIC ENERGY] ACCOMPANIED BY BRIG. GEN. THOMAS E. EGGERS, U.S. AIR FORCE, DEPUTY DIRECTOR FOR OPERATIONS; COL. ROBERT D. ORTON, U.S. ARMY, PROJECT MANAGER, BINARY MUNITIONS; AND CAPT. RICHARD E. MARSDEN, U.S. NAVY, PROGRAM MANAGER, BIGEYE; MICHAEL HUFFINGTON, DEPUTY ASSISTANT SECRETARY OF DEFENSE (INTERNATIONAL SECURITY POLICY)

Dr. BARKER. I will do so, Senator Exon. Thank you very much, Mr. Chairman, members of the committee:

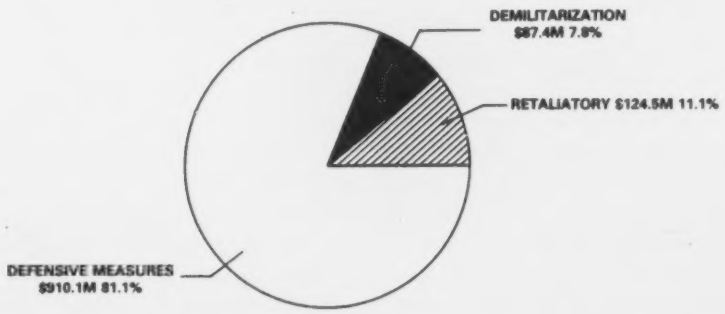
I have with me today Brig. Gen. Tom Eggers, Col. Bob Orton, and Capt. Dick Marsden, who are here to discuss the retaliatory chemical weapons program of the United States and to respond to any questions you may have with respect to the specific systems for which their services are responsible.

I do appreciate your permitting me to put my extended comments into the record. I would like to summarize them briefly with the benefit of a few vu-graphs.

The program that has been submitted by the Department of Defense this year is a continuation of the program approved by Congress last year. The principal objective remains the prevention of the use of chemical weapons against our forces. We believe that deterrence rests on two issues: one, a credible defense; two, the ability to retaliate in a credible way.

We are on our way down the path to accomplishing those two objectives with the support of the Congress. Of course the end objective is to deter the use of chemical weapons against U.S. and allied forces by the Soviets.

FY 88 CHEMICAL MODERNIZATION BUDGET



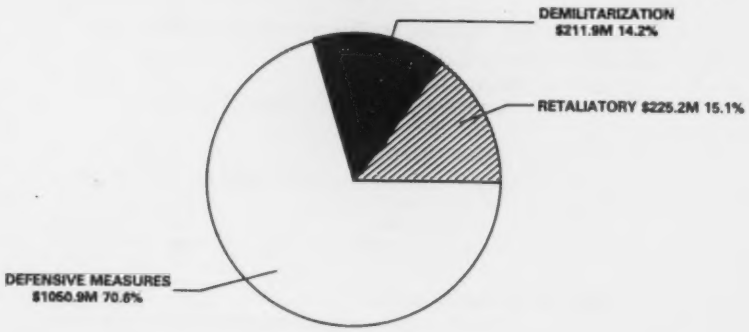
TOTAL $1122.0M

7-2861

This first vu-graph shows the split for fiscal year 1988. The lightest area is our demilitarization program, our attempt to destroy the largely useless stockpile of unitary weapons which currently

exist. The green is our retaliatory ability, our ability to enter the modernized area of retaliatory capability with binary weapons. And the large blue area is defense measures.

FY 89 CHEMICAL MODERNIZATION BUDGET



TOTAL $1488.0M

T-2581

So as you can see, defense has been the dominant part of the chemical weapons budget. In fiscal year 1989 you can see the trend that will increase as we go into the future. We will be starting to pay the bill for the destruction of the unitary rounds which constitute a nonuseful military capability and, at the same time, as far as I am concerned, constitute a menace just by the fact that these unitary rounds continue to exist.

We also will see as we go into the future an increasing green portion of the pie as our retaliatory programs come to maturity. In fiscal year 1988, the defensive program was 81 percent of the budget. And, as you can see, it decreased in its percentage as we went into fiscal year 1989.

Our defensive efforts to date have already been the result of a very successful research program. The thing that concerns us now is the fact that we have some evidence that the Soviet Union is turning in the direction of what we call "novel agents," agents which may be specifically designed to defeat our defensive gear.

Our research and development program is now directed toward developing what we call "generic defensive capabilities," which will work whether or not we know the fine details of Soviet chemical offensive weapons. We are trying to design capabilities that will respond in a general way, as opposed to the current technique we have been forced to use, which is to tune our defenses to the very specific nature of what we think is Soviet offensive capability.

The defensive program consists of collective protection shelters for fixed facilities, new lightweight decontamination systems, new detectors, improved protective gear, and new protective masks. But

the real emphasis that I want to focus on this afternoon is our retaliatory capability.

I want to turn to the two programs that we have in that regard.

REPORT ON FUTURE RETALIATORY SYSTEMS

- MILITARY REQUIREMENTS FOR LONG-RANGE STAND-OFF CHEMICAL WEAPONS
  - ADVANTAGES/DISADVANTAGES
  - POTENTIAL TO COMPLEMENT CURRENT BINARY SYSTEMS
- UNDER CONSIDERATION
  - AIR, SEA AND GROUND LAUNCHED CRUISE MISSILES
  - ARMY TACTICAL MISSILE SYSTEMS
  - AGM-130 GUIDED GLIDE WEAPON
  - HARPOON, ADVANCED INTERDICTION WEAPON SYSTEM
- METHOD OF EVALUATION
  - TECHNICAL SPECIFICATIONS PLUS COMPUTER MODELING TO DETERMINE EFFECTIVENESS
- REPORT AVAILABLE EARLY APRIL

7-3881

The retaliatory program is covered in detail in my statement, but let me cover a few details. The next chart summarizes the status of the fiscal year 1986 requirements. Of this list of requirements which came from the Congress, the only remaining task is the Presidential certification on final assembly, which cannot be submitted prior to October 1, 1987. The President must certify at that time that:

One, final assembly is in the national interest;

Two, performance, handling, and storage specifications for the systems have been met;

Three, Federal safety standards for handling and storage and other use are met;

Four, the chemical destruction plan is ready to implement.

We expect that the President will indeed be able to certify to all four of these at the proper time.

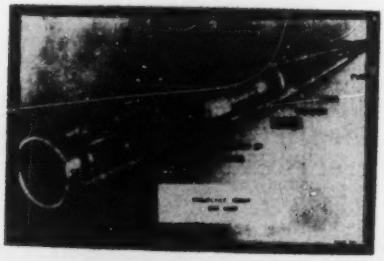
STATUS OF COMPLIANCE WITH LEGISLATION (CON'T) FY 1987

REQUIREMENT	STATUS
• PRESIDENTIAL CERTIFICATION ON BIGEYE PRODUCTION FACILITIES	PENDING (NLT AUGUST 1987)
• IN NATIONAL INTEREST	
• PLANS, DESIGNS, ENVIRONMENTAL DOCUMENTATION SATISFIED	
• REPORTS	
• FUTURE RETALIATORY SYSTEMS	TO BE SUBMITTED IN EARLY APRIL 1987.
• DEMILITARIZATION ALTERNATIVES	TO BE SUBMITTED IN LATE MARCH 1987.

The next slide shows what the Congress has asked of us in the fiscal year 1987 legislation. We expect to meet these requirements as shown.

There are three binary systems comprising our chemical modernization retaliatory program: the 155 millimeter artillery shell; the Bigeye chemical bomb; and the binary chemical warhead for the multiple launch rocket system, the MLRS. These systems make up our short range, deep strike, and intermediate range capabilities.

155 mm GB-2 PROJECTILES



	FUNDING ($M)			
	FY86	FY87	FY88	FY89
PROCUREMENT	20.6	59.3	59.3	65.6
FACILITIES	—	25.2	—	—

- PRODUCING PROJECTILE METAL PARTS AT LOUISIANA ARMY AMMUNITION PLANT
- UPGRADING/PREPARING DF FACILITY AT PINE BLUFF ARSENAL FOR OPERATIONS
- PROCURING CANNISTER METAL PARTS AND ALCOHOL FROM COMMERCIAL SOURCES
- CONTRACTING FOR DC FACILITY

Let me turn next to the discussion of the 155 millimeter binary chemical projectile. The status of the binary artillery projectile is shown on this chart. We are now procuring components for the projectile using funds provided in fiscal years 1986 and 1987. We have awarded contracts for binary chemical production, the projectile body, and the fuse.

Initial quantities of the projectile body have recently been produced at the Louisiana Army Ammunition Plant. The alcohol canister, which is one of the binary components, will be delivered already filled with the binary chemical component. We will not proceed with filling the other binary canister until the required Presidential certification with regard to final assembly has been satisfied.

We expect to be ready to assemble a complete binary projectile before the end of the year. Let me now turn to the Bigeye.

BIGEYE ISSUES

• CHEMICAL TESTING • AGENT PURITY • PRESSURE BUILDUP • FLASHING • AGENT PERSISTENCY	STATUS REPORT DUE TO SAC AND HAC IN AUGUST, 1987. EXPECT TO BE ABLE TO DELIVER REPORT BY JUNE 1, 1987
• OPERATIONAL EFFECTIVENESS AND SUITABILITY • ACCURACY • DEPOSITION DENSITY • RELIABILITY	ISSUES TO BE RESOLVED DURING CURRENT PHASE OF OPERATIONAL TESTING, FEBRUARY-AUGUST 1987. QUICK LOOK REPORT IN JUNE 1987.

7-3681

The Bigeye program is summarized here. The current phase of operational testing will provide the means to judge the effectiveness of Bigeye as a chemical retaliatory system. It is undergoing a realistic joint test which is being independently monitored by the Department of Defense and the General Accounting Office.

BIGEYE

FUNDING ($M)

• FY 86	
– PRODUCTION FACILITIES	90.0
– RDT&E (OPERATIONAL TEST)	6.0
• FY 87	
– PROCUREMENT (INITIATE LOW RATE PRODUCTION	34.4
– RDT&E (COMPLETE OPERATIONAL TEST)	5.0
• FY 88 PROCUREMENT	
– COMPLETE LOW RATE PRODUCTION	25.2
• FY 89 PROCUREMENT	
– FIRST YEAR OF FULL PRODUCTION	99.9

- PHASE II OPERATIONAL TEST UNDERWAY – FEB THROUGH AUG 87
- QUICK LOOK REPORT ON OPERATIONAL TEST RESULTS TO CONGRESS – JUN 87
- PRESIDENTIAL CERTIFICATION ON PRODUCTION FACILITIES – NOT LATER THAN AUG 87
  – PERMITS OBLIGATION OF FY 86 FACILITIES MONEY

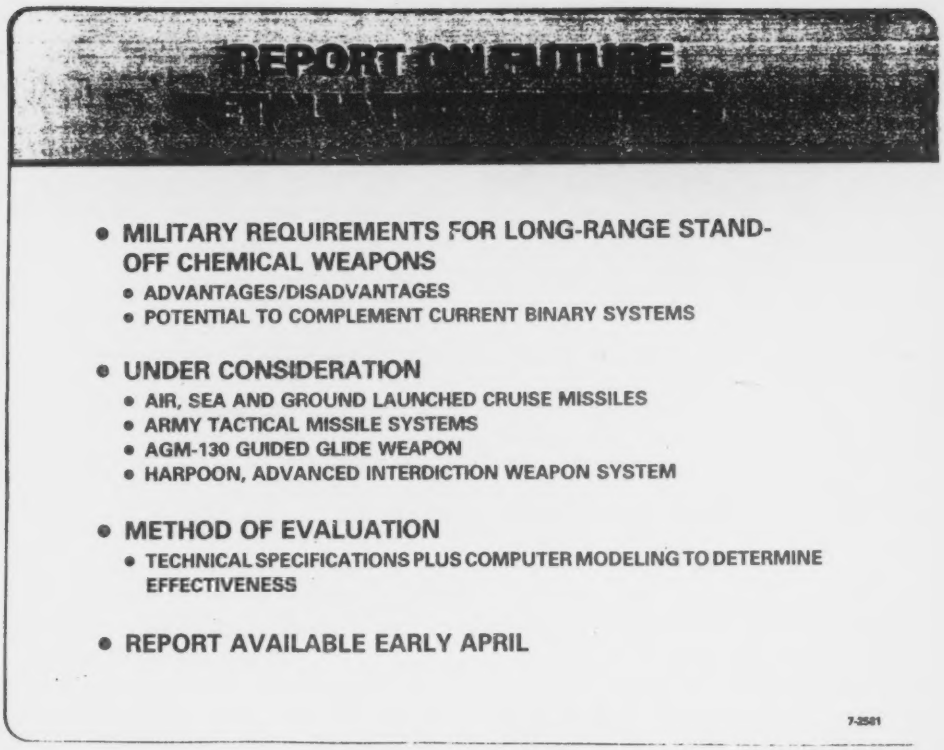
Last year, turning to the next slide, the Senate Appropriations Committee asked us to report on several issues related to chemical testing and operational testing of the Bigeye bomb. We believe the chemical testing issues will be adequately resolved through additional tests which are currently in progress.

The initial results have prompted us to continue with the program. The issues related to a operational effectiveness and suitability can only be resolved through the current series of operational tests. In each case, we expect to have the answers by February or March 1988. We will not go forward with the Bigeye unless it is successful in its test program. Slide off, please.

We have recently requested funds with which to complete previously requested low-rate initial production run. Full production should begin in fiscal year 1989, given acceptable operational test results. In accordance with last year's legislation, we will not proceed to final assembly of a complete Bigeye bomb before October 1988.

The binary chemical warhead for the MLRS, or multiple launch rocket system, is the third component of our binary chemical deterrent. It transitions from advanced development to full scale engineering development midway through fiscal year 1988.

As currently planned, this system would not be ready for production until fiscal year 1991.


REPORT ON FUTURE
• MILITARY REQUIREMENTS FOR LONG-RANGE STAND-OFF CHEMICAL WEAPONS
• ADVANTAGES/DISADVANTAGES
• POTENTIAL TO COMPLEMENT CURRENT BINARY SYSTEMS
• UNDER CONSIDERATION
• AIR, SEA AND GROUND LAUNCHED CRUISE MISSILES
• ARMY TACTICAL MISSILE SYSTEMS
• AGM-130 GUIDED GLIDE WEAPON
• HARPOON, ADVANCED INTERDICTION WEAPON SYSTEM
• METHOD OF EVALUATION
• TECHNICAL SPECIFICATIONS PLUS COMPUTER MODELING TO DETERMINE EFFECTIVENESS
• REPORT AVAILABLE EARLY APRIL
7-2581

In response to the request of Congress, we have prepared an analysis of potential deep-strike chemical systems to complement Bigeye. The report will be submitted next month. Should one or more of these systems prove to be a good candidate, we would look to pursue development with the intent to transition to the new system at such time as it is ready to produce.

We would expect such a development program to take about 10 years to complete. That being the case, Bigeye remains the near-term solution to our requirement for a deep-strike chemical deterrent.

Let me just take a few moments to summarize the three systems. In the 155 millimeter artillery shell, we are talking about using a nonpersistent binary chemical agent which will allow us to attack, or threaten the attack of Soviet concentrations of force. The agent is of a short-term persistence which adds to its military credibility to the extent that the Soviets know that we would not be denying territory to ourselves if we used such a shell.

The Bigeye bomb is designed to attack deep targets with a persistent chemical agent. These are to be used in deep areas where we would not expect our own troops to be for month-like periods, if ever. The purpose of this persistent agent is to deny territory to the Soviets for a long period of time. Such targets might be airfields or large assembly areas.

Today our stockpile consists of no deliverable long persistent chemical agent. We are faced, with today's stockpile, with the

almost impossible task of repeated delivery against a fixed target, because we do not have a persistent agent that we can use.

Beyond that, the delivery tactics necessary for today's stockpile are such that it almost guarantees that the aircraft will not return; because in order to deliver the agent, the plane must fly low and slow. So the very, very critical component of chemical modernization is to provide this country with a persistent agent which can be used against deep targets. The only system that is capable of doing that in the short term is Bigeye. In the longer term, we would look for other capabilities and, in response to the request of Congress, we are doing that in the slide I just showed.

In between the artillery shell and the Bigeye, we are looking at the MLRS system which provides intermediate-range delivery with an agent of intermediate persistency. That again is a capability we do not currently have and which is truly needed for deterrence.

In closing, I want to emphasize that the Department's 1988 and 1989 chemical modernization program is a logical step in continuing the course which Congress has already set us on. We are committed to ensuring that chemical weapons are never used against our Armed Forces. With deterrence as our objective we seek to build upon credible defensive and retaliatory capabilities, while continuing efforts toward a complete and verifiable Arms Control Agreement.

Concurrently, we will be executing the most challenging and necessary task of destroying our useless stocks of highly toxic materials. We look forward to continuing support from the Congress. My colleagues and I are now prepared to answer any questions you may have.

Thank you, Senator Exon, and gentlemen.

[The prepared statement of Dr. Barker follows:]

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PREPARED STATEMENT OF HON. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE [ATOMIC ENERGY]

Mr. Chairman and Members of the Committee:

I am Dr. Robert B. Barker, Assistant to the Secretary of Defense for Atomic Energy. I appreciate the opportunity to appear before the committee to discuss our chemical modernization program. I have with me representatives of the Army, Air Force and Navy for the purpose of answering any questions that you may have with particular reference to their area of responsibility. These witnesses are Under Secretary of the Army James R. Ambrose; Air Force Brigadier General Thomas E. Eggers, Deputy Director for Operations; Army Colonel Robert D. Orton, Project Manager for Binary Chemical Munitions; and Navy Captain Richard E. Marsden, Program Manager for the BIGEYE chemical weapon.

I have a prepared statement which I would like to present to the committee.

PROGRAM OBJECTIVES

The program submitted by DoD is a continuation of that which was approved by the Congress last year. The principal objective remains the prevention of chemical warfare through a credible chemical retaliatory capability and adequate defensive measures. Both are required if we are to effectively deter the use of chemical weapons against our armed forces. As we progress in achieving this program objective, the use of chemical weapons against U.S. forces or our allies will become less and less attractive.

Concurrently with these improvements in our military capability to deter chemical warfare, we are taking the initial steps required to destroy the lethal unitary stockpile of chemical agents and munitions which is now stored at eight sites in the United States and two overseas locations. We will destroy the unitary stockpile in conjunction with the production of binary chemical munitions as required by the 1986 Defense Authorization Act. Ninety percent of the unitary stocks have no military utility and should be destroyed expeditiously. The remaining ten percent will be retained for its limited deterrent value until an adequate binary stockpile is available. Given the availability of a safer, more effective binary alternative, the risk of continued storage of munitions which contain lethal toxic chemicals is unwarranted.

DEFENSIVE PROGRAM

Our efforts to improve the defensive posture of our forces have been notably successful over the last five years. Where we once talked about our inability to survive for more than a few hours under chemical warfare conditions, we now are able to sustain several days of operations. In the early stages of the program we relied on off the shelf items, some of which were only marginally acceptable in terms of their impact on operations. More recently, our research and development program is providing new and improved defensive systems, a fact that is reflected in the increasing share of our defensive program that is devoted to procurement.

In fiscal year 88 we are requesting $216 million for procurement of chemical defense items. This increases to $287 million in fiscal year 89. As a result of our active research and development program over the last few years, we are procuring a number of other new defensive items to include new protective masks, collective protection systems, decontamination devices, and alarms.

In the next few years, the defensive program will be driven by the advent of new technologies which are being increasingly applied to chemical agents and munitions in the Soviet Union and elsewhere. These "novel" agents and munitions blend a number of aspects of biotechnology, microencapsulation, and modern chemistry into a wide variety of weapons which could potentially negate many of our defensive gains in the longer term. To guard against that event, our program continues a broadly based research and develpoment program for defensive systems. The objective is to transition from defensive equipment tuned primarily to a few known chemical agents to a more generic system. The new system would recognize toxic hazards on the basis of their potential to attack critical receptor sites in the human body. Alarms, detectors, filters and supporting equipment must have the inherent flexibility to accommodate rapid change of software and detector mechanisms. Further, we must continue to evaluate our protective clothing and respiratory protection to incorporate improvements.

Our fiscal year 88 funding request for defensive research, development, test and evaluation (RDT&E) is $148 million. In fiscal year 89, we request $137 million. In addition, we are requesting $149 million in fiscal year 88 and $168 million in fiscal year 89 for medical research and development. The medical programs include work on antidotes, casualty handling and treatment equipment, and prophylaxis.

The chemical warfare and biological defense portions of our fiscal years 88/89 budget account for 81 and 71 percent of the entire chemical program in those years. The decrease in the percentage of the budget devoted to defense from fiscal year 88 to fiscal year 89 does not imply a decrease in emphasis on the defensive effort. Rather, it reflects the increase in the destruction and retaliatory procurement programs.

As was the case in World War I, competing chemical warfare technologies keep the initiatve with the offense. Defense, in conjunction with a credible retaliatory capability, is essential to prevent granting a decisive edge to the aggressor. However, defensive systems acting alone will not deny an advantage to those who could choose to initiate the use of chemical weapons.

RETALIATORY PROGRAM

The U.S. has maintained a chemical retaliatory stockpile for almost seventy years. During that period, the size, composition and location of that stockpile has been adjusted to meet variations in threat, operational doctrine and delivery systems. Our latest

effort to modernize the stockpile is consistent with these former changes. Since the bulk of our current stockpile of chemical munitions was produced in the 1950's, there have been a number of changes in the way we would expect to use our forces, in the systems used to deliver chemical munitions, in the threat we face, and in the environment under which we store and move toxic materials in the United States.

The change from the classical World War II front line oriented forward defense to the highly mobile air land battle doctrine, has made obsolete the delivery of long lasting persistent chemical agents by artillery. That change made useless our stockpile of persistent agent-filled artillery munitions. Similarly, the advent of follow-on forces attack and the increasing intensity of the air defense environment on modern battlefields, makes a deep strike persistent agent capability essential. Spray tanks, which require low and slow delivery, would doom the pilot and aircraft which employed them. The use of nonpersistent agent-filled bombs, requiring repetitious attack of heavily defended deep targets would also doom those who would deliver such munitions. Today, our air-delivered chemical retaliatory capability is wholly dependent upon such spray tanks and nonpersistent agent-filled bombs.

The use of rapidly deploying contingency forces to deal with crises in a number of remote parts of the world, calls for reducing the size and complexity of the supporting logistics system for moving and storing contingency quantities of chemical munitions. At the same time, the spread of chemical capabilities to more than 16 nations increases the probability that such forces will encounter chemical warfare in the future. Indeed, chemical weapons have been used in at least three places in the world in the past ten years where we have security interests: in Cambodia, in Afghanistan and in Iran.

Finally, the increased awareness of the threat to the environment posed by storage and movement of toxic substance argues for a chemical munitions capability which is safe and nonlethal until fired in combat.

These are only a few of the considerations that have led us to pursue modernization of the U.S. retaliatory chemical stockpile with modern, safe binary chemical munitions. The end result will be a smaller, safer, more readily deployable stockpile which is compatible with current doctrine and weapon systems.

There are three binary systems comprising our chemical modernization retaliatory program: the 155mm artillery projectile; the BIGEYE chemical bomb; and the XM-135 binary chemical warhead for the multiple launch rocket system (MLRS). These systems make up our short range, deep strike and intermediate range capabilities. The 155mm binary projectile is now in production. The BIGEYE bomb is in operational testing. The binary warhead for the MLRS will transition to engineering development in fiscal year 88 and will be ready for production in fiscal year 91.

155mm BINARY CHEMICAL PROJECTILE

We are requesting $59 million and $66 million respectively in fiscal year 88 and fiscal year 89 to continue full scale procurement of the 155mm binary projectile. We are now procuring components of the projectile. Using the funds provided in fiscal year 86 and 87, we have awarded contracts for binary chemical production, the projectile body, and the fuze. Other supporting contracts have been or are in the process of being awarded. Initial quantities of the projectile body have recently been produced at the Louisiana Army Ammunition Plant. The alcohol cannister will be delivered already filled with the binary chemical component. We will not proceed with filling the other binary cannister until the required Presidential certification with regard to final assembly has been satisfied. We expect to be ready to assemble a complete binary projectile later this year.

BIGEYE

BIGEYE plays a major role in our binary modernization program. We currently have no means to effectively attack deep targets with persistent chemical agents. The potential for use of persistent agents in conjunction with conventional attacks against air bases, logistics support complexes and troop concentrations is the single most effective deterrent to Soviet use of chemical weapons against the NATO reinforcement system. Further, BIGEYE provides the only means with which light expeditionary forces could launch retaliatory chemical attacks with their largely sea-based supporting forces.

BIGEYE is a state of the art chemical weapon which incorporates the latest binary technology, a newly developed radar fuze, and a capability for delivery by the most current aircraft to a deep strike target. It possesses a standoff capability of up to four miles and can be delivered in a variety of modes to reduce system vulnerability to that comparable to other modern systems such as MAVERICK and ROCKEYE.

BIGEYE fills our most critical need. The President's Chemical Warfare Review Commission noted that BIGEYE's deep strike mission as the most critical of the three proposed binary systems and that nothing in the current stockpile served that role. Meeting that critical need in the near term is of the highest priority.

The current phase of operational testing will provide the means to judge the effectiveness of BIGEYE as a chemical retaliatory system. It is undergoing a realistic joint test which is being independently monitored by the Director of Operational Test and Evaluation and by the General Acounting Office (GAO). We expect that the system will perform acceptably. The changes incorporated after the earlier tests should produce an acceptable level of reliability. If not, we simply will not buy this system. There are several residual test issues for BIGEYE that we are addressing through supplementary chemical testing or comprehensive review of previous test data. We are running a number of additional tests to

provide information on agent purity, particle size, and pressure build up. We have now completed several of these tests. We have also reviewed previous data on flashing. Reports on flashing, particle size and pressure build up will soon be provided to the committee and to the GAO. A few words with regard to each of these areas is instructive.

Flashing is a phenomenon experienced in unitary chemical munitions. The relatively large bursting charge in such munitions creates a mixture of finely divided agent particles and air which ignites in the presence of burning explosive. As a result, up to 30 percent of the agent can be destroyed. Since BIGEYE contains no bursting charge, flashing is not a problem in this system. Our report will detail the large volume of existing scientific data on flashing and demonstrate why, as noted by the GAO, the chances of its impacting on the effectiveness of BIGEYE are remote.

The particle size issue concerns the degree to which the dissemination simulant replicates the behavior of hot binary VX as produced in BIGEYE. The allegation was that hot binary VX would produce much smaller particles of aerosolized agent than the simulant. This would invalidate the dissemination data since the actual agent would not respond to gravitational and wind forces in the same way the simulant does. Our tests, the final report from which will be submitted to the GAO and the committee within the next few weeks, involved aspirating hot binary VX and the simulant into air streams under a range of conditions. The results show that the particle size of the agent and the simulant are virtually identical. We found no reason to expect that hot binary VX would be disseminated any differently than the simulant.

Pressure build up was seen as another potential problem for BIGEYE. It has been alleged that the bomb would explode due to internal pressure build up before it could disseminate its agent payload. This allegation derives from a destructive test conducted in 1982 wherein we allowed the reaction to continue without venting until the bomb failed structurally. It failed after four minutes at about 600 pounds per square inch. We have argued that a failure due to pressure build up was not possible during the maximum 30 second flight time of the weapon. We based our opinion on extrapolations of the pressure versus time curve for the reaction which implied that the pressure after 30 seconds would not be greater than about 450 pounds per square inch. In all subsequent tests, we vented the pressure at 300 pounds per square inch to insure safety in the reactor chamber. A supplementary test has now been conducted at the maximum expected employment temperature to validate experimentally the extrapolation of the pressure versus time curve. After one minute, we have found that the pressure reached 343 pounds per square inch. This is well within the 600 pound per square inch yield strength of BIGEYE. We are satisfied that our previous conclusion is correct. Pressure build up is not a factor in BIGEYE's ability to effectively deliver its payload to the target.

Additional testing is being conducted to validate the correlation between agent purity and biotoxicity over the most likely temperature range of employment. Two of these tests, one at ambient and one at 140 degrees fahrenheit have been conducted. The results which require lengthy evaluation and animal testing are expected in June. Preliminary chemistry indicates no change from our previous conclusion that adequate purity or biotoxicity can be expected over the required temperature range.

Additional reports concerning the persistency of binary VX and the storage stability of the binary component QL will be submitted soon.

We believe these results illustrate not only our interest in answering the questions but also the validity of our previous conclusions. It is important to note that the nation's expertise on this subject lies within the Department of Defense. The Chemical Research, Development and Engineering Center has conducted research in this area for over seventy years. Assumptions based on that background are not casual guesses. They are carefully reasoned judgements based on long and thorough scientific investigation of the issue.

Last year we received a portion of our request for procurement of BIGEYE with a restriction prohibiting use of the funds prior to October 1987. This year we have requested $25 million with which to complete the previously requested low rate initial production run. Full production should begin in fiscal year 89 given acceptable operational test results. Accordingly, we have requested $99 million in fiscal year 89 to support full production. In accordance with last year's legislation, we will not proceed to final assembly of a complete BIGEYE bomb before October of 1988.

Production facilities for BIGEYE were funded in fiscal year 86. Obligation of those funds is awaiting the required Presidential certification that production of BIGEYE is in the national interest and that plans, designs and environmental documentation for the facilities are complete. Two of the three facilities--the system integration facility which produces the bomb bodies, and the fill, load, assemble and pack facility--are ready for certification. The third facility--the QL production facility--awaits completion of environmental documentation which is expected in June. Assuming certification by July, initial delivery of unfilled BIGEYE bombs would begin in December 1988 using components procured beginning in November 1987 with fiscal year 87 and fiscal year 88 funds. Low rate initial production would continue for seventeen months with the full production contract beginning in April 1989.

BINARY CHEMICAL WARHEAD

The binary chemical warhead for the MLRS is the third component of our binary chemical deterrent. It provides the means to hold intermediate range targets at risk beyond artillery range but inside the usual operating range of BIGEYE delivery systems. It provides a

high volume of fire appropriate to the massed targets typical of that area. The warhead employs a new intermediate volatility agent with a degree of persistency between that of GB delivered by the 155mm projectile and VX delivered by BIGEYE.

The XM-135 binary chemical warhead for the MLRS transitions from advanced development to full scale engineering development midway through fiscal year 88. We are asking for $31 million in fiscal year 88 RDT&E funds for this program. In fiscal year 89, we request $29 million to continue full scale XM-135 development. As currently planned, this system would be ready for production in fiscal year 91.

FUTURE SYSTEMS

In response to your request, we have prepared an analysis of potential deep strike chemical systems to complement BIGEYE. The report will be submitted later this month. Should one or more of these systems prove to be a good candidate, we would look to pursue development with the intent to transition to the new system at such time as it is ready to produce. We would expect such a development program to take about ten years to complete. That being the case, BIGEYE remains the near term solution to our requirement for a deep strike chemical deterrent. A future system would be phased in by the late 1990's and could be accompanied by a product improvement for BIGEYE to achieve improved delivery accuracy or greater stand-off capability.

In summary, our retaliatory efforts in fiscal year 88 and fiscal year 89 comprise approximately 11 and 15 percent of our total chemical budget requests.

DESTRUCTION PROGRAM

In directing that the unitary stockpile be destroyed in conjunction with the production of binary munitions, the Congress has brought closer the day when we will no longer need to store or to transport toxic chemical munitions anywhere in the world. Ultimately, upon successful completion of the destruction program and binary chemical weapons production, we will have only twenty percent as many chemical munitions in our stockpile as we have today, and they will be safe and nonlethal in their binary form.

In this program, the Congress and the Department of Defense share a common goal. We share and support your interest in safely and expeditiously destroying this large stockpile of lethal toxic chemicals. Most of it has no military utility and continued long term storage simply prolongs the risk, albeit small, of an incident.

The Department of Defense is proceeding along a schedule which will allow us to meet the congressionally-mandated 1994 completion date. The plan laying out our strategy was submitted to the Congress in March 1986. At that time, we noted that the schedule was ambitious and that any number of issues--most notably the environmental process--could cause delays. We also noted that there

were alternative schedules which could be followed to take advantage of more conservative engineering approaches to the problem. The Congress asked us to submit such alternative plans and we are doing so this month.

In the meantime, we have implemented our plan for destruction of the stockpile by 1994. As required by that plan, we published a draft programmatic environmental impact statement (PEIS) on July 1, 1986. We have also initiated the process for obtaining permits for each of the disposal sites under the Resource Conservation Recovery Act (RCRA) and the Clean Air Act (CAA).

Public hearings have been held at each of the eight storage sites involved in this effort. The program was well received at the majority of the potential destruction sites. A significant number of comments were received during the public comment period, and as a result of those comments we are doing additional work in the areas of risk analysis and emergency preparedness. Substantial public concern was evident at two sites--Lexington-Blue Grass, Kentucky, and Aberdeen, Maryland. This led us to initiate major analytical efforts on two additional transportation alternatives. As a result of these and other actions related to the public comments, the Record of Decision previously planned for January 1987, has been delayed and is now expected by the end of this year. All other actions remain on schedule.

We are seeking the resources to support the 1994 program. We have submitted a fiscal year 1987 Supplement for 500 million dollars.

The Supplemental request includes those funds necessary to maintain the 1994 schedule under the most demanding option--that of on-site destruction at eight separate disposal sites. That is the most demanding of the three options in terms of resources required in the first two years of the program. In short, the Supplemental request makes it possible for us to execute any of the three options under consideration. Given the delay in the Record of Decision, we recognize that these funds cannot be obligated in FY87 as requested. Nevertheless, we have chosen to use the Supplemental process as a vehicle for this request to avoid encumbering the Army's Military Construction Program with a substantial resource requirement for what is, in the final analysis, a national problem.

The Supplemental funds requested will support simultaneous construction of on-site facilities at the eight storage sites. They also support initial procurement of time critical items such as furnaces and other unique equipment. Approval of the Supplemental request will ensure that resources are not the driving factor in meeting that very challenging schedule.

For fiscal year 88 and fiscal year 89 we have submitted requests for $87 million and $212 million, respectively. These Procurement, RDT&E, and Operation and Maintenance funds provide for routine procurement of baseline equipment, for program management, for continued investigation of alternative technologies and for

initial operations at Johnston Atoll. As part of the total chemical program budget, these requests account for 8 and 14 percent in each year.

I assure you, that in all areas, we are proceeding expeditiously to meet the 1994 deadline. The request for the fiscal year 1987 Supplemental funding is to ensure that availability of funds is not one of the obstacles in our path.

CONCLUSION

In closing, I will emphasize that the Department's fiscal years 88/89 chemical modernization program is a logical step in continuing the course which the Congress has already set for us. We are committed to insuring that chemical weapons are never used against our armed forces. With deterrence as our objective, we seek to build upon a credible defensive and retaliatory capability while continuing efforts toward a complete and verifiable Arms Control Agreement. Concurrently, we will be executing the most challenging and necessary task of destroying the useless stocks of highly toxic materials now stored in the United States and in two overseas locations.

We look forward to your continuing support and are now ready to answer any questions you may have.

Senator EXON. Thank you, Mr. Secretary.

I would just like to ask the gentlemen with you if they have any comments in addition to the remarks that you have just made. We would be glad to give you the time, if you think you could be helpful in adding to the excellent presentation made by the Secretary.

Dr. BARKER. Gentlemen.

General EGGERS. No, sir, we do not. We are ready for your questions.

Senator EXON. I thought that that would be the answer. You generally have that possibility, but this is a free society even though it is a closed session.

ARTILLERY-FIRED CHEMICAL WEAPONS

When you talk about the effect of artillery-fired chemical weapons, how long would such weapons inhibit our troops? Is that a matter of hours, or days?

Dr. BARKER. I will turn to Colonel Orton on that. I think you will be surprised how short a period it is.

Colonel ORTON. It is a matter of minutes.

Senator EXON. A matter of minutes?

Colonel ORTON. Yes, sir.

Senator EXON. If you launched one of these artillery shells, it impacts and in a matter of minutes our forces could go in there supposedly without any protective gear at all? Is that correct?

Colonel ORTON. We would use our NBC reconnaissance to make sure we were clear, but the persistency of that agent is a matter of minutes, 20 minutes, a half hour maybe, depending on the weather conditions and the situations we are in. But it does not impede maneuver on the mobile battlefield. That is the key to the close battle. We want to be able to cause them to button up, to put on their protective gear, to prevent them from becoming casualties, yet not impede our own movement on that battlefield as we go forward.

Senator EXON. That would be pretty much—from my limited understanding of military tactics—that would be quite akin to mustard gas in World War I? Is that a fair comparison?

Dr. BARKER. Go ahead.

Colonel ORTON. Mustard gas, sir, is more peristent and would tend to stick around for a longer time.

Senator EXON. A longer time?

Colonel ORTON. Yes, sir. This would be more akin to the lighter gases that were used in World War I like phosgene and chlorine, and some of the blood agents, the cyanides and so forth that came out in that timeframe. But these were more effective as casualty producers on the battlefield.

Senator EXON. Thank you. I have told staff we are on the 5-minute rule here. I will take another minute or two, and then I will defer to my friend from South Carolina.

BAN ON CHEMICAL WEAPONS

Late last year a high-ranking Soviet indicated informally in Geneva that the Soviet Union could accept the British offer of a ban on chemical weapons. Have the Soviets followed that up orally in the Conference on Disarmament talks? What can you tell us about that?

Dr. BARKER. In Geneva at this time the Soviets still have not crossed the very significant barrier of agreeing to challenge inspection—that is, mandatory access to what are called nondeclared facilities.

They have agreed to allow access in a short time to facilities that they have declared to be chemical weapons facilities. They have agreed to mandatory access in case of charges of chemical weapons use, but they have not yet accepted mandatory access to undeclared facilities.

Senator EXON. The British have been involved in this to some extent in these proposals. What is our reaction to the initiative by the British?

Dr. BARKER. One moment, Senator Exon.

We happen to have in the audience Deputy Assistant Secretary Michael Huffington, who has responsibility in the policy area for arms control as it deals with multilateral issues, and he is probably the best informed person here to answer that particular question.

Senator EXON. Could we hear from him?

Dr. BARKER. May I invite him to come up?

Senator EXON. Certainly.

Mr. HUFFINGTON. Sir, would you like me just to stand here?

Senator EXON. That is fine.

Mr. HUFFINGTON. The Soviets, as Dr. Barker has indicated, have said that they can use the British suggestion for inspection as a basis on which to negotiate. They are so far unprepared to either accept the British proposal or our own. We continue to have negotiations daily both on a bilateral basis and within the Conference on Disarmament.

That was the answer to your first question. I did not hear the second question.

Senator EXON. That was my question. Can you offer any prognosis of what the main sticking points are? As usual, I guess these things get related to other things in the conventional warfare area?

Mr. HUFFINGTON. The main sticking point between the Soviets and the United States is: Are we allowed to go into facilities within 48 hours to inspect for production? At this point, they do not want that, and some of our allies are also concerned about it.

We think it is absolutely necessary to be able to inspect any facility, because otherwise we believe that a ban would be unverifiable. We do know it is very difficult to have verification measures in inspecting for nuclear weapons, much less chemical production facilities.

Senator EXON. Your answer is that once again it is a matter of proper verification?

Mr. HUFFINGTON. Yes, sir, it is.

DEFENSIVE GERM WARFARE SYSTEMS

Senator EXON. My last question in this first round will be back to you, Mr. Secretary. Although you did not get into it this morning, I assume that defensive germ warfare systems are also under your jurisdiction as well as chemical warfare?

Dr. BARKER. That is correct.

Senator EXON. What can you tell us about the recent use of either germ or chemical agents, primarily in Afghanistan or in the war between Iran and Iraq? Can you tell us if biological weapons have been used? Have they gone to germ warfare testing, to our knowledge?

Dr. BARKER. To my knowledge, Senator, and I will certainly correct this for the record if I am in error, all that we have detected thus far are chemical weapons. Certainly in the Iraq-Iran conflict there is very definite evidence of the use of chemical weapons.

Senator EXON. On both sides, or just on one side?

Dr. BARKER. Just by Iraq.

Senator EXON. Iraq? OK.

Senator WARNER. Can you give us a date or time?

Dr. BARKER. Colonel Orton, can you help me?

Colonel ORTON. Senator, I cannot be precise, but they have used them on at least eight major occasions over the past 3 years that we are aware of, and including, in one instance, a very effective use of mustard to break up an assault coming down from the north that interrupted command and control on the Iranian side and produced large numbers of casualties numbering in the thousands.

Senator EXON. What is the most recent date? Within the last month has there been anything? The dates indicate it goes back a ways?

Colonel ORTON. Sir, I think we had best provide that to you for the record. It has been used, to my knowledge, within the last year. I will put it that way. I cannot talk—I do not know personally of anything.

Senator EXON. You indicated that it was quite effective in the Iran-Iraq war. Has it been equally effective in the other areas of the world?

Colonel ORTON. Some of the early uses were less effective because quite frankly they did not do it very well. They had problems with the bombs that they used not exploding when they hit the ground, and that sort of thing. Their proficiency has increased——

Senator EXON. Are these put in artillery shells, or bombs?

Colonel ORTON. They use both.

Senator EXON. Both?

Colonel ORTON. Yes, sir.

Senator EXON. Thank you.

My time is up. Senator Thurmond.

Senator THURMOND. Thank you very much.

Senator WARNER. Mr. Chairman, I wonder if in his response for the record he might also give an explanation of why there is apparently a forebearance by the Iranians, considering that they have that capability. It is my understanding that that capability has been present.

Senator EXON. I was hoping that would be the answer. If that war has been going as badly for Iraq as it seems to have been in certain areas today, is there a chance that that will be something they might turn to in desperation? Maybe we will leave that for follow-up.

[The information follows:]

Although the Iranians have made official pronouncements that they will not employ chemical weapons, we have noted in recent years that the Iranians are building a capability to produce chemical weapons. Their forebearance can be seen as one that has been significantly weakened by the repeated chemical attacks that the Iraqis have launched against Iranian battlefield forces. The Iranians had been unprepared to protect themselves and to retaliate. We believe this posture is rapidly changing. Although a basis research, development and industrial production capability was and is now present, chemical warfare agents and delivery systems were not a priority. [Deleted.]

Senator EXON. Senator Thurmond.

Senator WILSON. Mr. Chairman, I am going to have to leave. I wonder if we might add on to that request for the record what you may know of the use of chemical agents against the Afghans, and also by the Vietnamese against their opposition in Kampuchea.

Dr. BARKER. We would be happy to do so, Senator Wilson.

[The information follows:]

Chemical warfare agents have been used against the Mujahedin in Afghanistan by the Soviets from 1979 to 1983. Since 1983 there have been sporadic allegations of nonlethal chemical warfare use. We have been unable to confirm these more recent allegations. In Cambodia (Kampuchea) lethal chemical warfare agents and mycotoxins have been used by the Vietnamese forces. Soviet client forces (Laotian) also used chemical warfare agents in Laos. In Afghanistan the Soviet role was straightforward. In Laos they functioned as advisors and probably suppliers of the agents. Use in southeast Asia began in the mid-70s and continued through 1982. In both Afghanistan and southeast Asia, our assessment is based on the totality of the evidence from all sources and in some cases positive laboratory findings on samples collected from attack areas.

Senator Exon. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

Dr. Barker, is the fiscal year 1987 legislation creating an impediment to going ahead with any aspect of the chemical modernization program?

Dr. BARKER. There is one element of that legislation which is having an adverse impact, Senator. Can we put the chart up?

STATUS OF COMPLIANCE WITH LEGISLATION (CON'T) FY 1987

REQUIREMENT	STATUS
• PRESIDENTIAL CERTIFICATION ON BIGEYE PRODUCTION FACILITIES	PENDING (NLT AUGUST 1987)
• IN NATIONAL INTEREST	
• PLANS, DESIGNS, ENVIRONMENTAL DOCUMENTATION SATISFIED	
• REPORTS	
• FUTURE RETALIATORY SYSTEMS	TO BE SUBMITTED IN EARLY APRIL 1987.
• DEMILITARIZATION ALTERNATIVES	TO BE SUBMITTED IN LATE MARCH 1987.

The Bigeye production requires that the environmental documentation be satisfactorily provided—be provided for all facilities as a precondition to building facilities.

The way the law was written, the DOD general counsel has informed us that no facilities may be begun until all facilities have successfully passed their environmental approval. That means that two facilities are being held up, even though they have been approved environmentally, because a third facility has not yet been approved.

Senator THURMOND. Is that the way the law reads?

Dr. BARKER. I am not a lawyer, Senator, and I am therefore vulnerable to the general counsel's interpretation.

Senator THURMOND. I wondered if the lawyers were putting a strange construction on it.

Dr. BARKER. It would facilitate our program greatly, Senator, if we could find some mechanism to make clear the intent of the Congress with respect to this restriction.

We have been informed by several people that this was not the intent of the law. However, the general counsel tells us he must be bound by the way the law is written.

Senator THURMOND. Senator Wilson, I would yield to you if you wanted to ask some questions.

Senator WILSON. Well, thank you. That is very kind of you. Unfortunately, I have overstayed here and I have to go back in 3 minutes, but I thank you for your kindness.

BIGEYE TESTING

Senator THURMOND. Dr. Barker, can you tell us about the status of Bigeye operational testing to date? What portion of the testing program is completed, and what remains to be done, and have there been any anomalies in the testing program?

Dr. BARKER. Senator Thurmond, I would like to turn to Capt. Dick Marsden who is the program manager for Bigeye.

Senator THURMOND. I would be glad to hear from him.

Captain MARSDEN. Senator, we have started our operational test program. We actually started our flights in mid-February, and to date we have released 10 bombs out of the total of 58 that we have for this phase of testing.

We expect to complete this test phase, all 58 bombs, by the end of October. That is our current status.

Senator THURMOND. Are you satisfied with the progress being made?

Captain MARSDEN. Yes, sir, we are.

Senator THURMOND. Are you hopeful it is going to be a success?

Captain MARSDEN. Yes, sir, definitely.

Senator THURMOND. Do you have any evidence to that effect?

Captain MARSDEN. I'm sorry, sir?

Senator THURMOND. Do you have any evidence to that effect?

Captain MARSDEN. We have not received from our testers their categorization of the results at this time so we are not sure. Normally, they provide their test results after they complete all the testing. So at this point, things are going reasonably well.

Senator THURMOND. Dr. Barker, Congress will be following the progress of the Bigeye operational testing very closely this year in arriving at an authorization level for fiscal year 1988 and fiscal year 1989. What testing results are likely to be available to the Congress in time to shape these decisions?

Dr. BARKER. Senator, the desire for an independent testing process has led to a situation where the testers hang onto that data for quite awhile. We have been able to persuade them to provide us with an interim status report in the June timeframe, but that is the best that we could do.

As Captain Marsden just indicated, we will not have the full data on the test program until the end of October. We are hopeful that this status report, which will be available in the June timeframe, will be in time to have some influence on congressional support for this program.

Senator THURMOND. Dr. Barker, I take it the Department of Defense will not hesitate to cancel the Bigeye program if the weapons fail to satisfy its operational testing requirements. What fallback does the Department have for deep-strike chemical delivery capabilities if that unfortunate situation were to arise?

Dr. BARKER. We are not in a very good situation at all, Senator Thurmond. The Bigeye is the only near-term capability that we have for deep delivery persistent agent. I think the Congress very appropriately nudged the administration a year ago to do the study, which will be reported within a month in looking at follow-on systems.

Our current estimate is that it will take at least a decade to deliver proven chemical delivery capability with these follow-on systems. That is why Bigeye is so important to this country.

Senator THURMOND. My time is up, Mr. Chairman. Thank you very much.

Senator EXON. Thank you.

Senator Stennis.

Senator STENNIS. I have no further questions. Thank you.

Senator EXON. Thank you, Senator. Gentlemen, trying to keep the perspective on where we are right now—you have outlined where we are going and how fast we are going to get there. You also have a pie chart up there showing an overall limited amount of production now.

CHEMICAL WEAPON INVENTORY

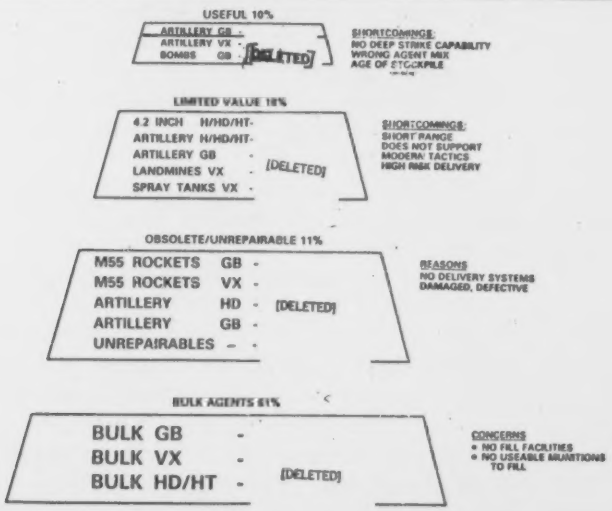
If war should break out next week in Europe, for example, and let us assume that there was an attack involving chemical weapons of some kind, how effectively could we retaliate with what we have in inventory, ready to use now?

Dr. BARKER. I think I will let Colonel Orton give you the sad answer to that question.

Colonel ORTON. Sir, right now we have a unitary stockpile that we have talked about in the past. Of that stockpile, only 10 percent could be characterized as being at all of use to us on the battlefield. The remainder is either bulk agent, not in weapons at all, or it is obsolete and unrepairable material that is candidate for the destruction program, or it is material that is of the 1950s vintage and not designed to support the tactical battlefield environment that we expect to encounter today.

CURRENT STOCKPILE MUNITIONS

[DELETED]



Basically what we have in the useful category are some artillery shells with a mix of agents that is not really our choice, but is useable on the battlefield; and some freefall bombs that have a nonpersistent agent. So they would be of primary use only in the forward area. They do not give us that deep strike capability with a persistent agent that we would very much like to have.

In summary, our retaliatory capability now is at best nominal.

Senator EXON. Putting that in terms that we laymen can understand, you and I are going to be involved in a pheasant-shooting

contest, and you have a 12-gauge automatic shotgun, and I am using a 410, and we are equal in our ability to shoot. I would think I would be at a distinct disadvantage in using a single-shot 410 and you having an automatic 12-gauge shotgun.

Is that a fair comparison, from what you know of the Soviet strength today, or anticipate that they would have? Or is it worse than that?

Colonel ORTON. I guess I would say it is a little worse than that. He has probably got two of them.

Senator EXON. Of course I am a darned good shot.

To draw a comparison that I can understand, you would say that that would be like me having a single-shot 410 and he would have two automatic 12-gauges. Is that right?

Colonel ORTON. I think that is fair, sir. Basically, if we go into a chemical battle tomorrow, we do it with one arm tied behind our back.

GERM WARFARE

Senator EXON. I do not believe I got a full answer to my previous question about germ warfare. Has there been any germ warfare used in either Afghanistan or the Iran-Iraq controversy, to our knowledge?

Dr. BARKER. What we do have evidence of, Senator, is that Soviet proxies have used toxin weapons in Southeast Asia. A toxin is produced by a living thing, in this case a fungus.

Senator EXON. That is what I call it.

Dr. BARKER. However, we do know that it is possible to fabricate some toxins by chemical methods in the laboratory. So here we have the strange case wherein if a toxin has been produced by a living thing, it is a biological weapon; if it is produced in a laboratory, it is a chemical weapon, even though it may be identical chemically.

So we believe—we have evidence. The President has indeed levied the charge in his report on Soviet noncompliance, that the Soviets have provided the weapons, the technology, to their proxies in Southeast Asia which have enabled them to employ these toxin weapons against their enemies.

Senator EXON. Thank you very much.

My time has expired.

Senator Thurmond, did you have further questions?

BIGEYE CHEMICAL WARHEAD SYSTEM

Senator THURMOND. Dr. Barker, you noted in your testimony that development of an alternative to the Bigeye could take up to 10 years. What accounts for this time period? Is it determined by the delivery system, or the chemical warhead system?

Dr. BARKER. The time delay is attributed to warhead development, Senator, and is based upon our experience with Bigeye. I must admit to some personal discomfort with what I have been told, because I would hope that should the worst happen and should the Bigeye results not be successful, that we could at least build on that experience and come up with a binary standoff weapon, in something less than 10 years.

BINARY SYSTEM

Senator THURMOND. Now some people, I do not think, understand the binary system. As I understand the situation, these chemicals would be transported separately to the theater of operations. Then it would be combined and become lethal just before use. Is that correct?

Dr. BARKER. The binary does not become a chemical weapon until the weapon has actually been launched. They are stored separately, so that the two chemical components are in different places in the United States.

They are transported to the theater, and the two components will be put into the shell, or into the bomb, just prior to use. But they are still not a chemical weapon until they have been launched. The two chemicals do not mix until after the shell has been launched out of the artillery tube, and in the Bigeye, the two chemicals do not mix until the bomb has been dropped from the aircraft.

Senator THURMOND. Well, it has been dropped, how can it be mixed after it is dropped?

Dr. BARKER. There is what someone has called a washing machine-like thing inside the bomb that literally mixes the materials up.

Senator THURMOND. So once the bomb has been dropped, it automatically mixes it and becomes lethal?

Dr. BARKER. Correct.

Senator THURMOND. It is not lethal until after the shell has actually been launched.

Dr. BARKER. It is not a chemical weapon, a lethal chemical agent, until the bomb has been dropped.

Senator THURMOND. The general feeling is that it is a lot safer to handle chemical weapons when they are prepared and delivered in that way. Is that correct?

Dr. BARKER. That is absolutely correct.

Senator THURMOND. If you mix them ahead of time, it could be very dangerous.

Dr. BARKER. If you mix them ahead of time, you will have the same situation we have today in that we are spending $65 million a year to guard a stockpile of unitary chemicals which is largely useless.

Senator THURMOND. $65 million a year?

Dr. BARKER. $65 million a year to protect today's inventory.

Senator THURMOND. What are you recommending? That they be destroyed, or what should we do?

Dr. BARKER. We strongly agree with the Congress that they should be destroyed.

Senator THURMOND. How soon?

Dr. BARKER. The Congress has——

Senator THURMOND. Can we hold them until we get the binaries prepared and use them in case of war tomorrow? Or should we destroy them today and run the risk?

Dr. BARKER. The chart that was shown a moment ago indicates that we have some [deleted] agent tons of material, of which only 10 percent, or some [deleted] tons, is useful. So even as a contingen-

cy, we only need to hold onto 10 percent of today's stockpile, and we should start destroying it, in my opinion, as soon as the capability exists to do it.

Senator THURMOND. Has there been a recommendation made to Congress to enact a law to that effect? Or do you have the authority now to do it?

Dr. BARKER. The Congress has passed a law which tells us we must destroy the unitary stockpile by 1994. It has not yet appropriated the monies to do that. We have asked for $500,000 in a fiscal year 1987 supplemental to allow us to start down that path—$500 million.

Senator THURMOND. $500 million is requested this year, that would save how much money by 1994?

Dr. BARKER. It would not be completed until 1994, Senator.

Senator THURMOND. What's that?

Dr. BARKER. We would not be finished destroying the materials—even if Congress appropriated the money, our destruction program would not start until fiscal year 1989, and it would take us about 5 years to destroy the large amounts of material that we have.

But once it is destroyed, each and every year thereafter we would save approximately $65 million a year, because it would no longer have to protect this unitary chemical stockpile.

Senator EXON. That is going to come up in the next panel, I would say, Senator Thurmond, but we appreciate your input now.

Senator THURMOND. Dr. Barker, what delivery systems have you considered in your study of long-range chemical strike systems to complement Bigeye?

Dr. BARKER. Senator, I would be happy to provide that for the record, but the short answer is, everything that the Army, Navy, and Air Force have told us is credible.

LONG RANGE STANDOFF CHEMICAL WEAPONS

The alternative long range standoff chemical strike systems considered to complement Bigeye are: Army Tactical Missile System (ATACMS); Powered GBU-15 Guided, Glide Weapon; Air Launched Cruise Missile (ALCM); Ground Launched Cruise Missile (GLCM); Sea Launched Cruise Missile (SLCM) Tomahawk Harpoon; and Advanced Interdiction Weapon System (AIWS).

Senator THURMOND. How do you feel about it?

Dr. BARKER. I think it is a pretty impressive list.

Senator THURMOND. Are you convinced that that is the proper course?

Dr. BARKER. I think that we must develop these standoff capabilities, Senator. We are spending a great deal of money to develop standoff conventional weapons. We have developed, and are continuing to develop, standoff nuclear weapons. The idea that we must literally fly a bomb—a chemical weapon—and drop it on top of a target is totally incompatible with the rest of our strategy.

So, indeed, the only thing that makes sense in the long term is a standoff delivery capability, but in view of the time it will take us to get there, we do need Bigeye soon.

Senator THURMOND. In other words, Bigeye is an "interim weapon" so to speak, until we get standoff like you have got in atomic weapons.

Dr. BARKER. That is correct, Senator Thurmond.

Senator THURMOND. Thank you very much.

Thank you, Mr. Chairman.

Senator EXON. We are in our second round. Senator Stennis would be next.

Senator STENNIS. I would yield to Senator Levin.

Senator EXON. Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

As I understand it, the President has agreed to withdraw our chemical capability by 1992 in Europe. Is that right?

Dr. BARKER. We have agreed in principle to attempt to accomplish that, Senator Levin, yes.

Senator LEVIN. Well, I am not sure I understand what is going on here. You have got some chemicals in Europe that have got some deterrent capability, as I gather.

Dr. BARKER. We hope so.

Senator LEVIN. Are you unilaterally withdrawing those chemicals by 1992?

Dr. BARKER. Let us say that the Government of the Federal Republic of Germany has some interest in us withdrawing that material. [Deleted.] But hopefully, as you indicated, it does constitute some deterrent.

It would be our objective to replace that limited capability with a more extensive and more useful binary capability in the longer term.

Senator LEVIN. But not——

Dr. BARKER. Under current plans, it would not be predeployed in Europe, but certainly could be deployed to Europe within a very short period of time with the approval of NATO ministers.

LIMITED DETERRENT

Senator LEVIN. So what we have got is, we have got a deterrent there now, deployed in Europe now, and have agreed to take it out at the request of the Germans. We got nothing in exchange from the Soviets.

What they want us to do is build a new chemical—"they" being our NATO allies—the defense ministers, they have said, you go ahead and build a new chemical deterrent to keep it away from Europe, unless we agree?

Dr. BARKER. That is an interesting characterization.

Senator LEVIN. Where is that wrong? Let me go through it again. We have got a limited deterrent there now.

Dr. BARKER. Very limited.

Senator LEVIN. Well, do you think it is worth having?

Dr. BARKER. It is all we have got, Senator.

Senator LEVIN. OK, we have got a limited deterrent there now. We have agreed, without getting anything in exchange from the Soviets, that we are going to withdraw it. We have got about 10 percent of the troops in Europe, but we are supposed to build this new chemical weapon, at 100 percent our cost, 90 percent of the troops in Europe are Europeans, not Americans. They want us to build the new weapon, and keep it away from Europe, except that they agree to it in time of crisis.

Now what is wrong with that characterization? What is erroneous about that characterization? Are the facts incorrect?

Dr. BARKER. I think the only thing that is wrong is——

Senator LEVIN. "Erroneous"?

Dr. BARKER [continuing]. Is erroneous, OK, is the fact that there is valid reason to be concerned about how credible that deterrent is that is currently in place.

It has the deficiencies of being very limited in number, the wrong kind of agent, limited delivery capability, and the fact that we are now today in the process of destroying much of our own unitary stockpile because we have a technology which allows us to deploy a chemical deterrent without constituting a hazard in peacetime storage.

Senator LEVIN. That is why I said we have a "limited deterrent" now. I will accept all your limitations. But we have got it there. It is like having Senator Exon's single-gauge shotgun there. We have got one there. So without getting anything in exchange for withdrawing it, we are producing two new chemical weapons at our expense which our allies will not store.

They have got 90 percent of the troops at risk, and we are supposed to provide a new chemical deterrent, keep it away from Europe, except that they allow it there in time of crisis, in exchange for withdrawing the limited deterrent we have there now.

I must now understand what the President is about. Why would he agree to this? It sounds like unilateral disarmament.

Dr. BARKER. It sounds like unilateral—yes.

Senator LEVIN. We have got a limited deterrent there now. We did not even exchange for it with the Soviets. We have got chemical talks going on. Why would we take away a limited deterrent that we have there now and not get anything in exchange for it from the Soviets?

Dr. BARKER. Would you suggest we leave it there, then?

Senator LEVIN. You are darn right. Get something for it. Why do we not get something for it?

Dr. BARKER. We are in the process of trying to negotiate with the Soviets the total elimination of chemical weapons.

Senator LEVIN. We have already told them we are going to withdraw it in 1992. What is their incentive? There will not be any chemicals in Europe. They are all going to be stored on American soil or on American ships at our cost.

Dr. BARKER. The issue of our cost here, you are absolutely and exactly right. I take no issue with you at all on that.

Senator LEVIN. We are trying to protect troops in Europe, 90 percent are the troops of our allies, and they will not pay a penny to protect their troops. That is how much they want that deterrent. It does not make any sense. I do not understand why the President would do something like this, this kind of unilateral move.

Dr. BARKER. I think we both know the answer to that, though, do we not, Senator Levin?

Senator LEVIN. No, I do not know.

Senator EXON. I do not, either.

Dr. BARKER. I believe that the Congress of the United States required NATO approval, NATO agreement as an element to our procurement of binary rounds.

Senator LEVIN. What does that have to do with unilaterally withdrawing what we have there now?

Dr. BARKER. It has to do with German concern about us leaving unitary rounds which we ourselves have characterized as less than safe on German soil.

Senator LEVIN. And they do not want the binary rounds there, either.

Dr. BARKER. I think that——

Senator LEVIN. They want a veto over that in times other than in crisis. Right? Then they have got a veto. Is that right?

Dr. BARKER. Sure.

Senator LEVIN. Well, my time is up, but this whole thing becomes more and more mysterious.

Senator EXON. Well, let me follow up on that, and then we will go to our next panel.

Senator Levin has gotten into a very interesting development of questions I had for a third round. I am pleased that Senator Levin has gotten into it.

I would phrase the question in another manner. Have the Koreans, or any of our NATO allies, spent 1 penny on either offensive or defensive chemical weapons?

Dr. BARKER. The defensive programs of some of our allies are very extensive. As a matter of fact, we have learned some things from them as part of our own development of defensive gear.

Senator EXON. You're talking about troops.

Dr. BARKER. I am talking about defending troops, or defending facilities, decontaminating military equipment. So there are defensive programs throughout NATO. I personally cannot speak to Korean or Japanese activities in that area.

Bob.

Colonel ORTON. [Deleted].

Senator EXON. OK, you have partially answered the question by saying that the Europeans are providing some defensive protection for their troops, and the Koreans are doing likewise, as I understand it.

Have either the Koreans or our NATO allies provided any money for deterrence? I do not basically consider defensive weapons a very effective deterrent. Is it true that neither NATO nor the South Koreans have put any money into chemical weapons for deterrent purposes?

Dr. BARKER. We have not, to my knowledge, asked anybody else to help us pay for the chemical weapon program. One of our national objectives has been to eliminate chemical weapons from the face of the earth. In that regard, we have in fact discouraged other countries from developing chemical weapon capability. We have spent a great deal of effort trying to discourage the Iraqi development of chemical weapon capability.

The short answer is no. To my knowledge we have not asked anybody to help us fund our program, and we certainly have not put a great deal of pressure on our allies to go out and develop chemical weapon capability.

Senator EXON. Well, it is not your fault, Mr. Secretary, but what we are getting at here gets right back to the old problem that we have had with our European allies all the time. That is, as Senator

Levin pointed out, 90 percent of the troops over there are their troops.

I think what we are doing in the movement with Bigeye and the other things reflects that, once again, NATO is basically looking to us to provide not only the money but the capability of building up and storing all the equipment that they would want over there in an emergency.

As one Member of Congress who has supported these programs because, as you know, I still think the Europeans should do more. Once again, I think they want us to provide the overall umbrella.

We have got the Bigeye, and we have got these intermediates, and we have got some artillery shells there. That is a deterrent, and they do not have to worry about it. I do not think there is a tougher issue in the Congress than what is coming up here, and I think it is a major concern of most of us on this committee.

Senator Levin has put his finger on it. I think there is a situation we are not recognizing that we should be insisting upon our allies doing more to provide for themselves. There is not anything controversial about this because chemical weapons have been and are being used in conventional wars.

So from this Senator, please take back to our allies the proposition that at least one Member of the United States Senate wants to go ahead with these programs, but it is somewhat suspect as to whether I am going to be left hanging out on a limb. If we are going down that road, that makes no sense to me. As Senator Levin says, you are even going to take out the 410 shotgun, and that is all we have got, without getting anything in return.

Dr. BARKER. Senator, if I may, I have been collecting notes over the last several minutes from my friends here in uniform who want me to make the point that they would like to be protected in the world whenever they may be sent, and they would like our deterrent to be credible anywhere in the world; but with the potential at least for chemical weapon proliferation, the threat of exposure of U.S. troops to chemicals throughout the world is such that our deterrent capability is necessary worldwide.

Stored in the United States, it can be transported anywhere. We do have the capability to transport the material rapidly. So it is not just a question of the NATO theater. We would need these capabilities anyway.

Senator EXON. Well, I think the major concern has always been, has it not, the Soviets using chemical weapons in conventional warfare on the NATO front. Sure, they could be used in Afghanistan, Nicargua, Cuba, the Indian Ocean, anywhere. That is the main threat, is it not?

Dr. BARKER. Certainly that is the threat we talk about. If we get into terms of which is the most likely area of use, then you may find the equation turned around. If we found ourselves involved in the Middle East in any way, shape, or form, it might be much more likely there. That event may be more likely than use in Europe. That is, of course, a very subjective judgment.

Senator EXON. All right, we will proceed. If it is all right with the committee, we will yield to Senator Levin for 2 minutes as he did not have a second round, and then we will dismiss this panel and go to the next panel.

Senator Levin.

Senator LEVIN. Thank you very much, Mr. Chairman.

CHEMICAL WEAPON BAN

I understand Dr. Barker, was that Mr. Huffington said that the Soviets have said in Geneva that they are prepared to use a recent British proposal on a complete chemical ban as "a basis for negotiation." That is apparently what the Soviets have said about the British proposal, that it is a "basis for negotiations."

My question to you is: Does the Defense Department believe that the British proposal is an acceptable basis for negotiation?

Dr. BARKER. I will turn to my colleague from the policy side.

Senator LEVIN. I only have a couple of minutes. Can you give me DOD's answer?

Mr. HUFFINGTON. Yes, Senator Levin. It is our belief that is a partial step and not an adequate step because their proposal allows for us, when we go to the Soviet Union, to be turned away from entering into a facility. We think we need the right to be able to go in and inspect.

Senator LEVIN. So is it fair to say that in our view it is not an acceptable basis?

Mr. HUFFINGTON. Yes, sir, it is.

Senator LEVIN. The other question is: Would you say that this new Soviet position, in any event, has advanced the negotiations?

Mr. HUFFINGTON. Everybody is talking a lot more now than they have in the last couple of years. So, yes, I think we are a little closer, but we still have a long way to go.

Senator LEVIN. So that it has somewhat advanced negotiations? Is that fair?

Mr. HUFFINGTON. Yes.

Senator LEVIN. Slightly advanced them?

Mr. HUFFINGTON. Yes, slightly.

Senator LEVIN. I have some other questions for the record.

Senator EXON. Thank you, Senator Levin.

We will dismiss this panel now.

At this time, I would like to welcome Hon. James Ambrose, Under Secretary of the Army, to the hearing. Together with Dr. Barker, Secretary Ambrose will cover two issues: Where we stand on a new chemical protective mask, and the status of our chemical demilitarization effort.

Both are important subjects. Last year, this committee encouraged the Army to get on with a decision on the mask. I understand that they have done so, but now we hear rumblings from various contractors about their being excluded unfairly. We need to address this issue, and I would like to have you talk about that and give us some information on what that is all about, if you can, Mr. Secretary.

On chemical demilitarization, we need to review where we are, and we need to understand what the potential overall costs look like.

Thank you for joining us today, Mr. Ambrose, and we will get on to these issues as soon as we hear from our ranking minority member, Senator Thurmond.

Senator Thurmond, do you have any opening statement?

Senator THURMOND. Mr. Chairman, I do not have an opening statement.

Senator EXON. I would start out by saying, Mr. Ambrose, that we will insert in the record the reported version, without objection, and I would ask, Secretary Ambrose, that you at this time proceed with a summary of what is in this information, and anything else you care to say. Then we will go to questions.

STATEMENT OF HON. JAMES R. AMBROSE, UNDER SECRETARY OF THE ARMY

Mr. AMBROSE. Do you want to take up the masks, first? They are not in the statement that I submitted.

Senator EXON. I think maybe let us take up the masks first.

Mr. AMBROSE. We have, as you know, had a long——

Senator EXON. Excuse me just a moment. Senator Stennis wanted to say something.

Senator STENNIS. I came to hear the proceedings, so go ahead.

Senator EXON. Thank you, Senator Stennis.

Mr. AMBROSE. Can you hear me all right down there? I am a world-class mumbler, and if you cannot, perhaps I could——

Senator LEVIN. What did you say?

Mr. AMBROSE. But if you cannot, perhaps a microphone could be provided.

CHEMICAL PROTECTIVE MASK

The masks have a long story of slow and, for a long time, unsuccessful development. We have reached the point in the last 6 months or so where we have masks that pass the prescribed test.

In that same period, we also have been seeking to possibly relieve the specifications if they were being stated too stringently. We have accomplished a much more systematic and quantitative review of the requirements which confirmed the requirements as being reasonable. So there were not any significant changes made in the requirements.

But in the meantime, after three or four unsuccessful attempts, two of the three developers of masks succeeded in passing all the tests. So we have said that now we are ready to go. Up to that point, I was simply not willing to go out and buy a mask that was known to have failed the prescribed tests and requirements.

One of the three failed certain of the tests for the third time in a row. Specifically, twice in a row after being told exactly what was wrong and exactly what to fix, they now complain that we will not give them a third chance, or a fourth chance, depending on how you count these. I took the rather strict position that you have had your chances, and that is it. Sorry you did not make it, but if we hold the game open for you on that basis, the others will have a right to complain that they are not fairly treated.

So we propose to acquire, in a competition, one supplier of those two, each one bidding on the mask with which he has passed the tests.

We propose, beyond that, to have him build the masks in production to show that not only can the mask be successfully developed

in a laboratory on a limited basis, but also that it is a good enough design that when we want to produce large quantities of them, it will work.

We know of too many examples of success in the small scale engineering environment where the work was hand-held by engineers, rather than production people, to feel that we have come to the end of the development cycle just by getting the initial tests passed.

This competition will be between these two, and it will be awarded on a price basis, since both have qualified masks.

We need a large quantity of masks. The estimate of need is around 2.4 million, as I recall. We also use a fairly large quantity in peacetime for practice. They wear out or are damaged beyond the point of useful repair. That number is something on the order of 120,000 per year. Our acquisition plan is to get a second source in as quickly as we can behind the first source; then to keep the two of them in competition with one another for an indefinite future.

The firm that has been making the older mask, the one that did not work well enough, the M–17, has complained that we are giving too much initial production business to the winner of this competition amongst two. He is in the courts at the moment with his complaint questioning our judgment on the way we are going about this acquisition plan. I cannot tell you how that will turn out. I hope, of course, unsuccessfully.

We are looking at, again, a game plan in which we shortly will pick one of two who have successfully demonstrated the mask and give them a contract for several years' worth of business at about half the anticipated rate of our total procurement. And as soon as he shows through actual production at the rate of about 10,000 a month, we will then turn those drawings and production information into a second competition to put another supplier in business. Then those two will have at each other from time to time, and keep both of them in business, to give us a production capacity that is both able to catch up fairly quickly with the shortage, which is many years in the making, and continue to supply a reasonable quantity of masks that are required on a replacement basis.

We have complaints from the loser, as I mentioned, on the competition for development, and we have complaints from a firm that has not in recent years been a participant in this development. In fact, going back some time they lost out in the original competition to be a developer.

Now they seek to force us into a position where it would be a winner-take-all continuation of a position that they have enjoyed for quite some years on the M–17 mask. We have simply said that was not appropriate, and we are not going to do it.

It will be up to the courts to take their position on the issues that they put in front of them.

I do not know whether I have told you too much or not enough. I will be willing to take any questions you have about it.

[The prepared statement of Mr. Ambrose follows:]

PREPARED STATEMENT OF JAMES R. AMBROSE, UNDER SECRETARY OF THE ARMY

I am James Ambrose, Under Secretary of the Army. I appreciate the opportunity to appear before your subcommittee to discuss the matter of demilitarizing and eliminating obsolete chemical munitions.

This task is a complex national problem. There is no disagreement from anywhere, or anybody, that it must be accomplished. There is, at least in some quarters, considerable disagreement about how to accomplish it. There are numerous strict and severe constraints, legal and procedural, direct and indirect, that are applicable: environmental impact, safety, oversight, and timing. Funds, of the general order of two or more billions of dollars, are required to pay for this task, but most of these funds have not yet been authorized or appropriated. Suggestions and threats of litigation, some competing with one another, have been raised in some localities and larger governmental jurisdictions, raising thereby the possibility of delay and uncertainty in completing the undertaking.

The munitions are currently stored at U.S. military bases and at overseas locations. Some of the details are classified. But, by and large, the typical storage consists of mixed types of munitions in substantial quantities. The typical munition contains explosive ingredients as well as chemical agent, so it cannot be handled as a simple material which requires only incineration. Storage and handling are accomplished under rigorous procedures and with special security arrangements and personnel. These precautions are not perfect. There have been a few low scale incidents. But the record is that there have been no casualties in the public sector in the 40-year period that these munitions have been in storage, or during previous transportation and destruction actions. We intend to maintain that record in the future.

The Army is the executive agent for the Defense Department for the destruction of these munitions. The Secretary of the Army is the decision authority for the final environmental impact statement, including selection of destruction techniques, handling methods (including any necessary transportation), and locations of demilitarization facilities. He has asked me to oversee the Army actions that may be required. Consequently, I have been personally involved in this subject for some time.

A draft programmatic environmental impact statement was published last July. It contains a considerable amount of information on this subject. Copies have been made available to the committee. The public hearings that have been held have made it clear that additional work had to be done, particularly on emergency planning with and for local jurisdictions, risk analysis, and transportation. Those efforts are in progress. I estimate that a final statement will be published late in 1987, after a Congressionally mandated review by outside experts. At my request, the National Research Council is forming such a group and will conduct the review.

I have attached to this statement a copy of my transmittal letter for the draft EIS. I express the same caution today that was in that letter. Meeting the Congressionally-fixed date of 1994 represents a severe constraint. It forces commitment to multiple concurrent facilities construction and operation. In particular, it requires us to commit to a single disposal technique which has not been applied to a complete scale or full-size plant, albeit we consider the component parts of such a plant to have been adequately demonstrated from a safety and capacity standpoint. We need discussion opportunities such as this hearing provides to exchange views on the problems we face and the merits and demerits of various alternatives that may be available to us. We particularly need your understanding and support for whatever approach is finally adopted.

We have a credibility problem with this matter—some of it arising out of past episodes; some of it due to the hazards, uncertainties, and emotions attached to these chemical weapons. The Army, acting under my strict instructions, is doing everything it can think of to make public information and explanations on every facet of its efforts. We want nothing to take place for which the public has not had full access and opportunity to make its various viewpoints known on a timely basis. I believe we have, thus far, accomplished this. This hearing gives us another very useful chance to answer any and all questions.

Attachment.

DEPARTMENT OF THE ARMY,
OFFICE OF THE UNDER SECRETARY,
Washington, DC, 14 March 1986.

Hon. BARRY GOLDWATER,
Chairman, Committee on Armed Services,
Washington, DC.

DEAR MR. CHAIRMAN: This letter is in response to Section 1412 of the 1986 Defense Authorization Act (PL 99-145) entitled, "Destruction of Existing Stockpile of Lethal Chemical Agents and Munitions," which directs the Department of Defense to submit a comprehensive plan to Congress by March 15, 1986, for destroying the unitary chemical stockpile by the end of fiscal year 1994.

As the Department of Defense Executive Agent for chemical munitions disposal, the Department of the Army has developed in response to that direction the Chemical Stockpile Disposal Concept Plan and is herewith submitting it to the U.S. Congress. In developing the Plan, the Army has consulted with the Environmental Protection Agency and the Department of Health and Human Services.

The Plan contains information on the technical issues involved in demilitarization of the diverse unitary chemical stockpile and also presents three alternative disposal facility concepts: a national destruction center; regional destruction centers; and onsite disposal at eight sites within the continental United States. Safety and health concerns, schedule and cost differences, medical support, transportation requirements, and environmental considerations are presented for the three alternatives. The Plan does not, however, state a preference among these alternatives because at this time the analyses that will determine the outcome are not yet complete. The process and timing for the selection of the alternative of choice are included in the Plan, as is a summary of the Army management concept for the entire demilitarization program.

I believe this Plan satisfies the requirements of PL 99-145. However, I want to make clear the fact that successful implementation of the Plan rests on several basic assumptions—first, that funds for the program are appropriated as requested; second, that the environmental process can be accomplished without undue delays; and third, that simultaneous construction of disposal plants is acceptable.

The third assumption, in particular, needs to be revisited. Inadequate funding and environmental and regulatory permit approval delays, which are outside the control of the Army can, of course, greatly affect the schedules. But more importantly, while schedules for all three facilities alternatives show that it is possible to complete the disposal of the unitary chemical stockpile by September 30, 1994, those schedules represent some degree of risk and may not be the most cost effective way of achieving the goal.

I believe it much more prudent that the Army complete and test the Johnston Atoll Chemical Agent Disposal System (JACADS) which is now being constructed and allow the results to be utilized in other plants, as required. This would also allow us to simultaneously continue developing and testing of an alternative process of dismantling the unitary munitions, called the cryofracture process, to determine if, in fact, its incorporation into the remaining facilities could result in significant cost savings.

Such a sequential process would require that the 1994 date be changed, hence it is not included in the submitted Plan. However, evaluation and incorporation of appropriate process changes allowed by such a delay would, in my view, provide the most logical demilitarization program.

We are prepared to discuss this matter further if you so require.

Sincerely,

JAMES R. AMBROSE,
Under Secretary of the Army.

Attachment.

COMPETITION ON MASK PRODUCTION

Senator EXON. Thank you, Mr. Secretary. The Congress, as you know, mandated competition on the masks because we anticipated it would be a fairly large contract. Is it true that one of the largest, if not the largest company that has made things of this type before, was disqualified on the grounds that its masks presented for tests did not pass the tests on two occasions. Is that correct?

Mr. AMBROSE. No. There are two different companies here, Senator. The producer of the prior mask, the M–17, was not one of the three developers.

Senator EXON. Was not what?

Mr. AMBROSE. The producer of the M–17 was not one of the three developers. They had fallen out of that contest some years ago when their mask, or their offering, for whatever reason, was not considered to be equal to the ones that remained.

Senator EXON. So they did not submit a mask?

Mr. AMBROSE. No. They simply said to pay off these developers. It is no problem to make these things in production, and give us a shot at the whole business right here and now. And I said that we are not ready to do that. We need to be sure that these masks that we are talking about can be produced in quantity.

They have taken us to court complaining about that.

The second company was actually offered a mask that had been developed by the British for their own service. They submitted that mask in the competition and we, after the prior failures, said let them in. We need any candidates we can get. We are not doing very well here, and we have not been for years. I made the same offer to the current supplier of the M–17, but they did not accept it.

Senator EXON. Let me back up then to when this all started. Was it your intention that the company that developed the state-of-the-art mask would be given favoritism as far as awarding the final contract was concerned? In other words, it sounds to me like, from listening to your testimony, you kind of welded together here those who presented the best mask, and they kind of felt that since they presented the best mask that they were entitled to the contract. Is that a fair statement?

Mr. AMBROSE. No. I do not consider it an entitlement or a favor to them. I simply say that the completion of the development of an item of this sort does not come until you show me that you can make them in quantity production, rather than one or two at a time. That is an essential ingredient of anything that is going to be bid in the millions. The first production is a part of the development.

Senator EXON. You mentioned a British manufacturer. They were excluded and, if I understood you correctly, you said that you knew beforehand that that mask simply would not meet your requirements?

Mr. AMBROSE. Three or four years ago, the situation, which had come about some years before I got in the building, was that there were two developers in competition with one another for variations of what was at that time called an XM–30 mask.

The XM–30 mask was derived in part from the prior current-use mask, the M–17. Had either or both of those shown a successful development at that time, they would have been the winner of that competition, including price bid, would have been given a production order.

Both of them failed. At that point, the Army said that they could fix it. The failures were not too complicated. I told them they had been at it for 15 or 17 years, that I wasn't so sure they knew what they were talking about, but to go back and take another crack at it.

They did that. They came back and failed again to pass the test. So at that point, I said, all bets are off. We need a mask of some kind that works.

Senator EXON. Excuse me, Mr. Secretary. "They" failed the test. What do they say to that? They did not fail the test? Or do they agree that they failed the test?

Mr. AMBROSE. There is no dispute about that.

Senator EXON. There is no dispute about that?

Mr. AMBROSE. No.

But I have not yet brought you up in time to the introduction. I had just reached the point at which I said, since you two who are following the XM-30 path have not succeeded, the game is open. Anyone else who can come in and tell me that they have a mask that will work, if it is a reasonable proposition, we will test them, too.

The British appeared with the mask they had developed for their own purposes and said, here is one that we think will work. So I said, fine. Let them in. Test that, too. And we did.

The strange part of the story then begins, because on the next round they all failed, all three, the two that had been in who fixed their masks up, supposedly, and the British mask.

We gave them another chance. This time—and this now brings us up to last fall—this time, the British mask failed again, and the failures included the same failures as previously. So they simply had not fixed it as well as they should have.

The other two had finally, and I underline "finally" because it was a long, long process with many prior failures, finally passed the test well enough that we were persuaded that we at last had reached the point where we had good masks.

At the same time, we had the pressure, which was certainly warranted, from the Congress to get on with this thing. So we said, that is it. Two have passed, and we will pick one of the two. The third one, that is too bad. I felt particularly sorry about the outcome, because I am the one that had given them the opportunity to get in there, not just once but twice. That is the way it turned out. So I regrettably told them they didn't make it.

We are going to have competition between the two masks that did pass. That brings us up to the present. Obviously the losers are not very happy.

Senator EXON. Well, they never are.

Mr. AMBROSE. Had we left the third one in, the two others would have every right to complain that we had changed the rules of the game in the middle.

Senator EXON. Do you feel you have met the requirement that was outlined in last year's Conference Report in this regard? I do not happen to remember this; but I am advised that in the Conference Report we asked you to give full consideration to those masks which had already incorporated pre-planned product improvements, as had the British manufacturer. With this in mind, do you feel that you have met the requirements of the dictates of that Conference Report?

Mr. AMBROSE. Yes.

Senator EXON. The British mask has been accepted by two NATO nations, and is being considered by a number of others. I

cannot quite understand that. Why are other people accepting the British mask, as are our NATO allies, and we are not? Our standards are higher, I presume? Is that the answer?

Mr. AMBROSE. That is part of the answer. Our tests are more stringent to verify the claimed results, and some of the claims were not realized in the masks that were submitted for tests.

We have any number of examples—including some that the Congress has insisted on—where we are asked to test weaponry or equipment of other countries. We find that these are generally typical problems; that the requirements are not as severe and the tests are not as stringent. I do not think in most instances there is any basis for us to back off our position.

We had a classic example just last year in the 9 millimeter pistol, you probably recall, where the problem—without going into the whole business—revolved around the United States putting a little extra cushion in its requirement to be quite sure that it could fire all NATO ammunition. The other countries do not worry about that sort of thing as much as we do.

But the rules should be laid down properly beforehand, and they were. There was no doubt in anybody's mind, that I am aware of, as to what the requirement was, or what the test procedure was, and the would-be bidders were given all the information on their test results.

Senator EXON. What is the situation right now, Secretary Ambrose? We are not producing any masks, I presume? Or are we? Has the court action closed it down, or slowed down the production line?

Mr. AMBROSE. We have issued—is that correct—we have issued the RFP. The request for proposals is out on the street, and presumably the two bidders who are allowed to bid are preparing their responses.

In the meantime, one of the disaffected contractors has gone to court asking for a preliminary injunction to stop us from doing this. The judge has refused the request for a temporary injunction, but he has not ruled on the substance of the issue. We are in one of these hard-to-predict proceedings of just how much evidence, and how much procedural activity will be required before we can get a ruling. But it has not stopped the procurement, as we plan it, and will not unless we get some judicial ruling that we cannot do it.

Senator EXON. Unless an injunction is issued at some point, is that correct?

Mr. AMBROSE. Yes. But I cannot tell you when that judge will rule. In the meantime, we are just going to keep on going. We are way overdue.

Senator EXON. Mr. Secretary, in our previous panel as you probably heard, we got into some discussion of the destruction of the existing stockpile of chemical weapons.

SUPPLEMENTAL BUDGET REQUEST

Let me start out the discussion on that in this fashion with this question: In your supplemental request for fiscal year 1987 you requested $500 million for chemical demilitarization purposes. You have also requested $87.4 million for this purpose for fiscal year

1988, and another $211.9 million for fiscal year 1989. At the same time, you indicate that you will not select a specific option for accomplishing the demilitarization of existing stockpiles until later this year.

Why should we approve these huge sums of money before you can tell us how you intend to proceed?

Mr. AMBROSE. When we prepared the paperwork that led to that request, we were trying to cover the worst situation that we could visualize. Namely, meeting the 1994 date of the Congress, and with the need to build concurrently the entire set of facilities, there being eight or nine of them all together.

While that was not the whole of the money, we felt that would be sufficient to get the program underway without missing the date.

Since that request was prepared and worked its way through the whole process of getting over here on the Hill, we have had to delay the environmental impact statement for additional work. A number of Members of Congress have raised the possibility that the 1994 date was not a reasonable one to attain.

There are a number of factions, and a number of lines of thought about all this. Some want to cause the transportation of these chemical weapons to central disposal facilities; others do not want that to happen. There is a lot of present litigation out there waiting to get a shot at all this.

So in the evolution of this, I think it is quite clear, and we acknowledge it, that we cannot spend all of that money. We cannot spend most of it, in fact, by commitment in fiscal year 1987. But what we were trying to do was provide for the beginnings of what I think should be a means of funding this kind of a program such that the entire fund will be available when it is needed. The total cost of disposing of these munitions is on the order of $2 to $2.5 billion.

I think we would feel that it would be appropriate to find some way of working out a method whereby we could draw on the money when and as we could get released from the various environmental and threatened litigation proceedings.

Bob, did you want to speak to that further?

Senator EXON. Before you do, Mr. Secretary, are you telling me you have testified that you cannot use all this money. Are you thinking of building up a kitty? Is that what you are doing?

Mr. AMBROSE. Well, at least to have a drawing account of some kind, Senator.

Dr. BARKER. Let me help, Senator Exon.

We estimate that we can spend about $10 million of the $500 million on design, and we can spend another $110 million this year on equipment. That is only $120 million of the $500 million we have requested. We asked for the supplemental for two reasons, however.

One is to make sure that dollars would not be a limiting factor in the administration's ability to meet the congressionally-mandated destruction date of 1994 for all the material.

The other reason we chose a supplemental was to highlight that this really is a national program. We would not want to burden the Army's military construction budget with this big, additional in-

crease. We wanted to highlight it by making it a separate supplemental, to make it clear that it is, indeed, a national program.

The Army, Mr. Ambrose, has taken on a significant burden in trying to implement this program for the country, but the Army ought not to bear any burden or penalty in terms of its overall budget from having done so. First we wanted to highlight the additional monies as a national obligation to destroy the materials. Second, we did not want dollars to be the thing that caused us to fail to meet the 1994 deadline.

The amounts that are in the 1988——

Senator EXON. But there is no way the dollars would ever reach that.

Dr. BARKER. I'm sorry? The dollars would never reach?

Senator EXON. I am talking about the supplemental.

Dr. BARKER. Yes.

Senator EXON. In other words, when you asked for the supplemental, you really thought you could spend that much money. Is that correct?

Dr. BARKER. No. We did not think——

Mr. AMBROSE. Excuse me. If we had the firm date of 1994 and no prospective change, if there were no insistence from the Congress that we look at alternative methods of different technologies, and if we did not run into heavy weather on litigation, then we felt we had a mandate from Congress which we were trying to satisfy to get rid of this stuff by 1994, we would have and could have committed the money along the lines that were asked for.

Senator EXON. Had it not been for these intervening matters. Is that correct?

Mr. AMBROSE. Yes.

Senator EXON. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

Mr. Secretary, we are glad to have you with us.

Mr. AMBROSE. Good to see you, Senator.

Senator THURMOND. What happens to the chemical destruction program if the supplemental request is not approved?

Mr. AMBROSE. Go ahead, Bob.

Dr. BARKER. The half a billion dollars asked for in the fiscal year 1987 supplemental are dollars needed to meet the congressionally-mandated deadline of 1994. If we do not get the supplemental, we will require an additional $390 million in fiscal year 1988, over and above what the administration has asked for; and we will need an additional $100 million in fiscal year 1989 in order to meet the 1994 mandated destruction deadline.

Senator THURMOND. In other words, it will just be carried over to the next 2 years.

Dr. BARKER. Correct, except for $10 million, a very small fraction.

Senator THURMOND. Is that wise?

Dr. BARKER. I do not think so.

Mr. AMBROSE. Senator, the reason I was a little hesitant is that I have not completely given up on finding a scheme for meeting the 1994 date, but I have to tell you that if we do not get some relief from the many conditions that are being imposed here, we will almost surely not meet that date.

Now we can get a line of argument from some people that it is just as well to take longer because then we will be able to build a facility and operate it at Johnston Island, and we will know better what to do with the remaining facility, and possibly even save some money.

We will get an argument from some people that says there are better methods then the one we are using and we should take our time and sort that out.

On the other side of it, you know that some of these chemical munitions are not good things to keep around indefinitely. We think we have the time to dispose of them in an orderly way, but I do not think anyone believes we have an indefinite period.

Senator THURMOND. What is the estimate based on? Have you had people to bid on it?

Mr. AMBROSE. We have not had a complete bid made, but we have the bids for construction on Johnston Island as a reference. We know what those costs are.

We have had the Ralph Parsons Co., and other——

Senator THURMOND. How many bidders did you have on that?

Mr. AMBROSE. I do not know that. I will have to get you the answer to that, Senator.

Senator THURMOND. Well, I just wondered if there was a lot of competition on this, or if somebody had a monopoly.

Mr. AMBROSE. No, I do not think that is the case. The construction—one problem, one thing that I want to change, Senator, is that that Johnston Island construction was started under a normal, piece-wise, in-house-managed arrangement where the Corps of Engineers would let a contract for the buildings; the equipment would be procured under yet another line; and the operations would be conducted under a third funding line by still another group.

I think the way to get rid of this material is to let a single contract for the entire job at all remaining sites, and for the construction and facilitization and operation, so as to get a major contractor who is capable in these matters to do the entire job, under close control.

If we go down that path, I am sure that there will be ample competition at that level among the major people who do that kind of work in this country. That is, I think, much preferable to doing this thing in little bits and pieces where the competition is at the wrong level, and only part of the job.

We do have reasonably good Corps of Engineers' estimates and contractor-produced cost estimates on which to give you the figures that we have.

Senator THURMOND. Well, this is a big problem. Is EPA going to be involved?

Mr. AMBROSE. They have given us both help and trouble, Senator. Their rules are very stringent, but we have had close collaboration with the Public Health Service, the EPA, FEMA, all of the people who need to be involved in this process.

Senator THURMOND. I hope you do not have any marshland involved in this appropriation.

Mr. AMBROSE. I am sorry, Senator?

Senator THURMOND. I said, I hope you have not got any marshland involved.

Mr. AMBROSE. No, but I have to tell you, Senator, that in bygone days in the mid-1920s, somebody had the foresight to declare this Johnston Island as a National Wildlife Preserve. So we have the same rules applicable out there in the middle of nowhere that we have in the continental United States with respect to protecting game and wildlife, fish in the ocean, and so on. So we are getting more help there than we can really use.

Senator THURMOND. Thank you, very much.

Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond.

Next is Senator Humphrey, but before I introduce him, I am going to ask you a question and then I will withdraw it: After listening to you, Mr. Secretary, why did you take this job? I withdraw the question.

I am very fearful you would take the Fifth Amendment, and I do not want that to happen, so I withdraw the question and recognize Senator Humphrey.

Mr. AMBROSE. Would you accept an answer, even so? I resign every night. That way, I do not have to take my work to bed with me, so I can sleep soundly.

Senator EXON. Thank you, Mr. Secretary.

Senator Humphrey.

Mr. AMBROSE. Excuse me, Senator Humphrey. In answer to Senator Thurmond's question, there were four bidders. They were all major. On the Johnston Island, there were four major companies who are bidding: Stern Catalytic got the job, but Ralph Parsons, Burns & Roe, and Kellogg were the other bidders. So you see, they were quite responsible people and they were not fly-by-night outfits.

Senator EXON. Thank you.

Mr. AMBROSE. Excuse me, Senator.

Senator EXON. Senator Humphrey.

Senator HUMPHREY. Are there any natives on Johnston Island?

Mr. AMBROSE. We have several hundred people there who think that we have confined them to native status, but there are no natives. They are all civil servants or military personnel.

Senator HUMPHREY. I see. What is the underlying geologic formation there, do you know?

Mr. AMBROSE. That is a coral island.

Senator HUMPHREY. Coral?

Mr. AMBROSE. Yes.

Senator HUMPHREY. I am looking for a place to get rid of some nuclear waste.

Mr. AMBROSE. I think you will find plenty of Greens and Peace ships floating around there. They have already made it clear that they do not want us dumping any of this chemical material in the ocean.

CHEMICAL DEFENSIVE PROTECTION SYSTEMS

Senator HUMPHREY. Dr. Barker, could you give us a rundown on the adequacy of the chemical defensive protection systems nowadays?

Dr. BARKER. We have come a long way, Senator. As witness, the budget in the defensive area, we are starting to build some of the hardware that is a result of that research program, including collective protection shelters for fixed facilities as well as personnel defensive gear.

The concern we have is that, while our information is very limited, our concern is that the Soviets are turning to what we call "novel agents." There is some indication that their objective may be particularly to penetrate and defeat the defensive gear that we have designed, [deleted].

What we are trying to do now in our research program is to see if we can develop some defensive gear that will work across a broad range of potential future chemical attacks, so that we will not have to change our defensive equipment every time we get a new idea about what the Soviets may be developing.

Mr. AMBROSE. I might supplement that by saying we must not lose sight of the detection equipment and the decontamination equipment. Those things are quite important, especially being able to sort out with the detectors just what it is that is being thrown at us. That is a very difficult technical job.

Senator HUMPHREY. Apart from your research effort, what is the situation in the field now versus a couple of years ago?

Dr. BARKER. Let me have Secretary Ambrose respond to that question.

Mr. AMBROSE. There has been improvement, but it is really only partly there. I would characterize it as marginal yet. The problem is that the suits we presently have are stifling to work in.

Senator HUMPHREY. So there have been no improvements in what is in the field in personnel gear?

Mr. AMBROSE. That is substantially correct. There are limited special micro-cooled suits, for example. In some cases, we have now—in the M–1 tank, for example, we have gotten an overpressure system so they can work better. So we are moving in the right direction, but it is a slow process.

Dr. BARKER. While it may be somewhat simplistic, one of the ways we used to describe our defensive capability is that we would conduct war for hours in a chemical weapon environment. We now talk about surviving for days. But even days is not very impressive in terms of the size of the threat we face.

Mr. AMBROSE. We are also learning through some experimental work at the Natick Laboratory in Massachusetts of ways to relieve the stress, and ways to make people function effectively longer by proper feeding methods, and with cooling around the chest and head.

I think that once we are satisfied that these things are validated, we can move rather quickly to implement this, especially the feeding schemes, water, salt, water, and the like. That would give us marked, immediate improvement. But we are still a couple of years away.

Senator HUMPHREY. We were alarmingly vulnerable the last time I looked. It does not sound like the situation has changed much.

Mr. AMBROSE. I do not think you could fairly say it has.

Senator HUMPHREY. Would it help the situation if we deployed greater numbers of the systems we have? Do we still have a shortage in the numbers of pieces of equipment? Or are you just saying the design is not there?

Mr. AMBROSE. I think it would be unwise to make large additional investments in the current systems.

Senator HUMPHERY. Should there not be a real urgency attached to this? Are we not alarmingly vulnerable to a chemical/biological event?

Mr. AMBROSE. Yes.

Senator HUMPHREY. Should there not be a greater emphasis placed on an urgency in this program?

Dr. BARKER. One measure of the urgency I think, Senator, is the nature of the budget. If we could put up the budget pie chart, we are spending $1 billion a year on chemical weapons' activities, and 81 percent of that is in the defensive measures area right now. So it is not for lack of trying; it is just that it is a tough job, and we have a long way to go.

Mr. AMBROSE. I do not know where we have come up short in conveying the urgency to you. There is certainly no lack of urgency on our minds.

Senator HUMPHREY. Well, let me answer that question. You are giving the impression of a lack of urgency when you say there has only been marginal improvement over an alarming situation in the last couple of years.

Mr. AMBROSE. I think it has its roots in the United States essentially getting out of this chemical business in every respect quite some while ago, and in the process of that dismantling the people, organizations, and facilities that were competent in this activity.

It has taken some time to get that back, and it is not made easier by the obvious arguments that go on about whether any of this should be pursued.

From a career standpoint, it is a difficult choice for someone in the uniformed military to choose a career which went out of business, and may again go out of business shortly. So there are real problems in getting this activity up to full speed.

Senator HUMPHREY. Well, I certainly would agree with you that there has been a lot of congressionally-induced turbulence in the production of weapons, but we are talking now about defensive efforts.

You are spending $910 million on defensive research and production? Is that correct?

Mr. AMBROSE. Yes, $910 million.

Senator HUMPHREY. Do you have the figures for 1987 and 1986 for defensive measures?

Senator EXON. You had a chart on that, did you not?

Mr. AMBROSE. I think it was somewhat less. It was $700 million for defense.

Dr. BARKER. Let's see. Fiscal year 1987, Senator, it was $660 million in that same area.

Senator HUMPHREY. Do we have a goal, a set of goals, to provide x number of pieces of certain kinds of equipment by a certain year? Is there a timetable to improve upon the situation in terms of deploying equipment?

Mr. AMBROSE. Well, Senator, before you can deploy the equipment you have to have equipment that works. In the detector business, we have equipment that does not work very well. We have, nonetheless, bought quite a bit of it. The M8A1 equipment is not very good equipment, but nonetheless we have bought something like 25,000 units. I have stopped them from buying more because I did not think it was worth spending that much more money on.

We are trying to develop a detector that uses something like mass spectroscopic principles to actually identify the species being used, so that we will know whether we are being spoofed or not. That turns out to be a very difficult job, and there have been a number of failures.

We are not ready to produce such equipment, because it does not exist in a producible form. So regrettably we are up against a tough problem where the obscurants are ordinary things like diesel motor fuels, smokes that are used on the battlefield, and so forth.

BATTLE DRESS OVERGARMENT

Senator HUMPHREY. What do you call that rubber suit, or whatever it is, that protective suit? What is the name of that?

Colonel CARRUTH. Battle dress overgarment.

Senator HUMPHREY. Battle dress overgarment. Has that been improved? Have there been any breakthroughs on that one basic piece of equipment?

Mr. AMBROSE. We have some quite promising work in the laboratory, classified work, as it should be, [deleted].

We have instituted what I would call a rush program to see if we cannot get production samples of those materials in the next year or so. If it is as successful as the first laboratory samples would seem to indicate it might be, we will rush that into production on a high volume rate. But we do not have the answers yet that would allow us to defend it appearing in next year's budget.

Senator HUMPHREY. If I may ask just one last question?

Senator EXON. Go ahead, Senator.

Senator HUMPHREY. Are each of our NATO infantry people supposed to have one of these overgarments, each of the Americans?

Mr. AMBROSE. Each of the Americans, yes. Actually we have quite a bit more of the current garments in storage.

Senator HUMPHREY. You have more than one for each over there?

Mr. AMBROSE. Yes. I do not know what the exact numbers are, but there are stored many millions of overgarments.

Senator HUMPHREY. Is it possible to fight in that thing?

Mr. AMBROSE. Not for very long.

Senator HUMPHREY. What about the mask?

Mr. AMBROSE. The Russians have the same problem, incidentally. It is not completely a one-way street. The best of their garments, of which we have samples, are worse.

We currently have something over 2 million M-17 masks. That is all that we would need. The reason we want a new mask is that this one does not provide as much protection as we feel we need. We have forecast that against a Russian heavy attack we would

have a much larger number of casualties than we think is reasonable.

Senator HUMPHREY. I just want to close with the observation that if we are moving toward reducing nuclear weapons in Europe, tactical weapons, we are going to be more and more up against the old conventional superiority concerns, and it is especially worse, as you know, in the area of chemical/biological warfare.

Mr. AMBROSE. We completely agree with you, Senator.

Senator EXON. Thank you, Senator.

And a special thanks to you, Dr. Barker, and to you, Secretary Ambrose. We appreciate your coming over. We told you that we would try and get you out of here by 5 o'clock, and I am going to do that.

We are going to keep the record open until close of business tomorrow for other questions that will be submitted. I have a few additional questions, and I think it would be just as easy if you would answer them for the record.

So to save our time here, I will thank you.

Dr. BARKER. Thank you, Senator Exon.

Mr. AMBROSE. Thank you, Senator Exon.

[Questions for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR J. JAMES EXON

INCINERATOR DESIGN AT JOHNSTON ATOLL

Senator EXON. Later this year, the full-scale chemical demilitarization facility at Johnston Island will begin operations. Should we commit ourselves to specific incinerator design for use at sites in the United States until we gain more experience with the operation of the Johnston Atoll facility?

Dr. BARKER. The technology to be used for destroying the chemical agents and munitions is incineration. This method was chosen by the Army and endorsed by the National Academy of Sciences as the best and safest process for destroying the stockpile. The Army is developing two processes for accessing the agent prior to incineration. The first process is called reverse assembly, meaning the parts of the munition (agent, explosives, fuze, etc.) are separated prior to incineration in different furnaces. The Johnston Atoll disposal facility will use this process. The second is called cryofracture, which cyrogenically cools the whole munition, then fractures the munition into pieces before placing into a single incinerator. The incinerator design is basically the same for either process. DOD has submitted a report to Congress that discusses different schedule options for destroying the chemical stockpile. The report includes schedules that delay construction of follow-on facilities until after full scale operational verification of Johnston Atoll facility. Disposal operations at Johnston Island are scheduled to start in 1989.

CRYOFRACTURE TECHNOLOGY

Senator EXON. The "cryofracture" technology is apparently quite promising for destroying existing chemical weapons, yet the Army has not completed a full evaluation. Should we commit ourselves to the incineration approach until we learn whether cryofracture might be a much more cost-effective approach?

Dr. BARKER. First of all, it must be made clear that cryofracture and the Johnston Atoll "baseline" approach both use incineration for destroying the chemical agents and munitions. Therefore, incineration is not the technology question. That question is whether to use cryofracture for accessing the agent, instead of the reverse assembly baseline process the Army is currently using. The Army is well along with the reverse assembly process, having used it at Rocky Mountain Arsenal, Colorado to destroy nerve agent and mustard agent filled munitions and at Tooele Army Depot, Utah to destroy nerve agent filled rockets. The reverse assembly process will be used in the Johnston Atoll facility. In order to complete a full evaluation of the cryofracture process, a full scale facility must be constructed and operated. Currently, the Army is conducting incremental tests of the cryofracture process at the Chemical Agent Munitions Disposal System (CAMDS) in Tooele Army Depot. A full

scale cryofracture facility will be constructed if the dual technology evaluation option is selected. This option is one of five options included in the report submitted to Congress in March 1987 that considers cost effectiveness and reduces programmatic uncertainties.

TARGET DATE FOR DEMILITARIZATION

Senator EXON. Would you recommend relaxing the 1994 target date for complete disposal of the existing stockpile? If so, till when?

Dr. BARKER. We do not recommend relaxing the 1994 target date. We need to move ahead expeditiously with destruction of the unneeded munitions and agents. There are many uncertainties in the schedule projections. More refined estimates must await the receipt of actual production data following the start of disposal operations. Until then, the 1994 target dates is as good as any.

TARGET DATE FOR DISPOSAL OF EXISTING STOCKS

Senator EXON. If the target date for complete disposal of existing stocks was relaxed to, say, 1999, what would the funding profile look like for fiscal years 1988 and 1989?

Dr. BARKER. In the Chemical Stockpile Disposal Plan Supplement provided to Congress in March 1987, five alternatives to the 1994 schedule are discussed. Below is a listing of the funding requirements for all the various options for fiscal years 1988 and 1989. First is the current President's Budget and the second is the revised funding requirement to meet the 1994 deadline without the 1987 supplemental. The funding for the five options is listed below the dashed line.

FUNDING REQUIREMENT

[Dollars in millions]

	Fiscal year 1988					Fiscal year 1989				
	MCA	PROC	O&M	RDTE	Total	MCA	PROC	O&M	RDTE	Total
Budget	—	—	83.9	3.5	87.4	—	123	88.2	0.7	211.9
1994 Sch	147.0	144.5	94.1	3.5	389.1	127	163	109	0.7	399.7
MBP (Op 1)		74.1	93.0	3.5	170.6	111	127.5	95.5	0.7	334.7
JOT (Op 2,3)		19.5	79.4	4.9	103.8	—	—	86.4	2.8	89.2
DTE (Op 4,5)	26.0	50.4	85.9	4.9	167.2	4.7	33.4	88.7	2.8	129.6

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

AIR/SEALIFT FOR CHEMICAL WEAPONS

Senator LEVIN. How much of our strategic air- and sealift would be required to move militarily significant supplies of binary chemical weapons from the U.S. to Europe in a crisis or war? With your answer please supply both the C–141 transport sortie equivalents and the number, types, and tonnage of binaries used in your answer.

Dr. BARKER. Military planning for the reinforcement of EUCOM reflects use of both strategic airlift as well as strategic sealift. In the event the decision was made to deploy binary chemical munitions (BCM), the method of movement (airlift, sealift, or combination of both) would be highly dependent on the timing of the movement decision.

In a best-case scenario, the decision to deploy BCM would be made to deter a Soviet chemical attack and before the war plan for Europe is implemented. In this case we would use sealift to move the BCM from the CONUS to Europe. A container ship carrying enough BCM to support [deleted] days of retaliatory operations can travel from CONUS to Europe in seven days. A total of [deleted] days are involved from start to finish, consisting of [deleted] days from a central depot like Tooele, UT to an east coast port, [deleted] upload at the port, [deleted] days transit at sea, [de-

leted] offload at the European port, and [deleted] in-theater transport to the combat field unit. In this most favorable case, sealift would close the BCM before their required use and no airlift would be needed.

In a worst-case scenario of a no-warning Soviet chemical attack, we would use airlift to support the first [deleted] days of operations. This would require approximately [deleted] C–141 equivalents daily which is less than [deleted] percent of the [deleted] airlift capability and less than [deleted] percent of each day's lift. Simultaneously, surface movement would take place for the BCM needed for the last [deleted] days of the potential [deleted] chemical war. The arrival of BCM via surface on day [deleted] would allow airlift dedicated to this movement to be reapplied to other preplanned cargoes at that time.

In a more likely case, we would have indications of the need for and receive the appropriate approval for BCM deployment which would allow eight days of movement by sea before chemical retaliation began. In this case, airlift would begin on day [deleted] and would discontinue on day [deleted] when the sealifted munitions arrive at their destinations. This case requires [deleted] C–141 equivalents for [deleted] days which is less than [deleted] percent of the [deleted] airlift capability.

The BCM requirement to support [deleted] days of retaliatory operations consists of approximately [deleted] and [deleted]. The total weight is about [deleted].

CHEMICAL-CONVENTIONAL WEAPONS TRANSPORT TRADEOFF

Senator LEVIN. What conventional equipment and supplies would you opt not to ship in order to make room for binary chemical weapons deployed in the United States? How would the lack of those conventional items affect our conventional deterrent in a crisis, and our conventional capability in war?

Dr. BARKER. USCINCEUR determines the priority for movement of cargo to support a war in Europe. The impact of delaying previously scheduled cargo in order to transport BCM is situation dependent and can only be roughly estimated in peacetime. USCINCEUR would determine the impact at the time of the crisis or war by assessing the situation and deciding if BCM are more important than other items. The replaced cargo would then be deleted or rescheduled for transport according to the CINC's priorities. Additionally, timing is a significant factor. What previously scheduled requirements would be deleted or delayed would depend on when the decision was made to deploy BCM.

DETERRENT CREDIBILITY OF CHEMICAL WEAPONS

Senator LEVIN. Do you consider the 10% of the current stockpile which you define as militarily useful to be either a credible deterrent or an adequate military supply? Given that it comprises only 20% of the current stockpile and it will not be forward deployed, what makes the proposed binary program either a credible deterrent or an adequate military supply?

Dr. BARKER. The useable 10% of the unitary stockpile is neither a credible deterrent nor an adequate military supply. Deterrence depends on our adversaries' perception of our capacity to effectively retaliate and our will to do so. Our current useable stocks of unitary munitions were produced over 25 years ago to support Korean War doctrine. They are not compatible with current doctrine for military operations. The artillery munitions are range limited, contain the wrong chemical agents and cannot be moved rapidly enough to support today's tactics. We currently possess no viable capability to employ persistent agent beyond artillery range.

The fact that a credible chemical warfare deterrent can be achieved by binary munitions with only 20% of the agent tonnage in the unitary munitions is due to the increased capabilities of these binary chemical weapons and the fact that the binary stockpile is being designed to support modern tactics. With the proposed binary stockpile, we can influence the entire battlefield with the right munition agent mix suited to today's battlefield doctrine. We will have the capability to deploy it rapidly in sufficient numbers and types to be a worldwide deterrent. As long as the Soviets and other potential adversaries know we have adequate numbers of effective readily deployable binary munitions, deterrence will be achieved.

MEDICAL RESEARCH AND DEVELOPMENT

Senator LEVIN. You noted in your testimony that DOD requests $149 million in fiscal year 1988 and $168 million in fiscal year 1989 for "Medical Research and Development". You also noted that "The medical programs include work on antidotes, casualty handling and treatment equipment, and prophylaxis."

Do those medical programs also include research and/or development of new chemical agents or toxins? If so, for what purpose, offensive weapons or defensive countermeasures? Specifically, what kind of new agents and/or toxins?

Dr. BARKER. No, our medical programs do not include research and/or development of new chemical agents or toxins.

The medical research and development program consists of medical chemical warfare defense and medical biological defense.

The medical chemical defense research program develops soldier level prevention and protection, decontamination and medical management of chemical casualties, medical countermeasures to conventional CW threat agents and investigates emerging (new) threats as they are identified by the intelligence community. The level of research efforts on defense against new agents is dictated by the varying degrees of confidence placed on the threats. Currently, mechanistic and drug screening studies aimed at developing countermeasures to a new class of potential agents, canister penetrants, are underway.

The research program conducted on the medical defense against biological warfare (BW) is directed toward the development of vaccines and drugs to protect against the threat of potential BW agents, including toxins. Toxins which are being studied as part of this program are those which occur in nature. All research on the medical defense against toxins is conducted in accordance with the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and Their Destruction.

Developments planned within these programs for fiscal year 1988 and fiscal year 1989 include pretreatments, antidotes and prophylaxis; skin decontaminants and barriers; pretreatment and protection; and a survivable collective protection shelter designed for medical casualty treatment.

DESTRUCTION OF UNITARY NERVE AGENT

Senator LEVIN. I am told that in an unclassified briefing conducted by officials of the Chemical Arms Munition Disposal System facility at Dugway Proving Ground, Congressional staff were told that for every pound of unitary nerve agent destroyed, 2.5 pounds of toxic waste is created.

Is that accurate? If not, what is the proper ratio? If it is accurate, what plans do you have for disposal of that waste? At what cost? Please supply the total amount of unitary nerve agent to be destroyed and the total amount of toxic waste created by that destruction.

Dr. BARKER. The primary wastes generated during destruction of unitary chemical agents are (1) scrap metal parts from the munitions and containers, (2) ash residues from incinerators, and (3) dried salts recovered from pollution abatement system scrubber brines. The quantities of waste generated vary with chemical agent and munition or container.

The metal parts are not considered by the Army to be hazardous waste. These steel and aluminum components will be thermally treated to destroy any residual agent or explosive left on their surface. The detoxification process will result in the production of inert scrap metal which can be recycled. Due to the organic nature of the materials being disposed of, very little ash is expected to be generated. The principal exception is ash generated from burning wood dunnage used in storage of munitions. This ash has the same characteristics as ash produced from the combustion of any wooden material. The pollution abatement system scrubber salts are considered hazardous under the requirements of the Resource Conservation and Recovery Act (RCRA) (because of trace quantities of heavy metals, not agent) and disposal must be in accordance with RCRA guidelines. The dried salts are not considered toxic and are, in fact, equivalent to wastes generated by industrial plants. These products result from the neutralization of combustion products such as hydrogen chloride, hydrogen fluoride, and oxides of sulfur, prosphorous and nitrogen.

In mustard agent processing, 2 to 2.5 pounds of salt and ash residues will be generated per pound of mustard incinerated. Less than 2 pounds of salt and ash residues will be generated per pound of nerve agent (either GB or VX) incinerated.

The current plan for disposal of these hazardous wastes calls for the use of RCRA approved and licensed commercial landfills. Selection of contractor(s) will be by competitive procurement. This procedure has been implemented at the prototype plant in Tooele, Utah and at Rocky Mountain Arsenal, Colorado. Costs range from $.25 to $.27 per pound of salt and ash residue.

The total amount of nerve agent to be destroyed is some 28,220 tons. At 2 pounds of salt and ash residues for each pound of nerve agent, the estimate amount of residue from disposal of nerve agent is 56,440 tons.

QUESTIONS SUBMITTED BY SENATOR DAN QUAYLE

TIME NEEDED TO DEVELOP DEEP STRIKE CHEMICAL WEAPONS

Senator QUAYLE. In your testimony on pages 13 and 14, you state that it would take 10 years to develop a deep strike chemical capability that did not rely on piloted platforms. Why so long; don't we have deep strike cruise missiles already in our Tomahawks and small binary warheads in our 155 rounds?

Dr. BARKER. I believe the 10-year figure represents a "business as usual" approach. Certainly, high priority and appropriate funding levels could reduce this time by a year or two but probably not much more than that. Attempts to accelerate the program by more than a year or two would probably cause costs to go up geometrically.

The problem is not one of simply putting the binary warhead of the 155mm rounds into existing Tomahawks or other weapons. We must match the right binary technology to the system being considered. The 155mm rounds produce a nonpersistent nerve agent which is not what we want for deep targets. We must also develop an agent production mechanism that is appropriate for the system and takes advantage of the long range system's unique capabilities. For example, the spin and setback mixing technique which works well in artillery is not appropriate for cruise missiles which might be better suited to a submunition approach. The development of this process and packaging into the chosen delivery system takes time. The 10-year estimate I referred to earlier was based upon the Army's experience in developing a binary chemical warhead for the multiple launch rocket system (MLRS). That development effort will take about 10 years by the time we field the chemical MLRS in 1991.

REQUIRED ACCURACY OF DEEP STRIKE CHEMICAL WEAPONS

Senator QUAYLE. How accurate would you want your deep strike chemical weapon to be? Against what targets would accuracy be desirable for delivery of chemical munitions?

Dr. BARKER. The accuracy of any future deep strike chemical weapon should be comparable to that of other systems used in that role. In that sense, accuracy means reliably getting the delivery vehicle to the target.

For chemical systems, accuracy is complicated by weather. Chemical spray from a delivery system will drift at the speed of the prevailing wind and the drift distance will depend on the height of dissemination above the ground. Systems which can compensate for wind direction and speed at the target will more accurately place the chemical payload on the objective. Alternatively, the use of sub-munitions can overcome wind effects by uniformly distributing the agent on the target at or near ground level.

In every case, we are interested in getting agent on the target in the desired density. We also want to limit as much as possible any off-target effects.

In general, these considerations apply to [deleted].

DEEP STRIKE CHEMICAL WEAPON DESIGN

Senator QUAYLE. Do you intend to design our deep strike chemical weapons system to deliver a unitary warhead or to be able to attack several targets on one flight by using dispensable chemical munitions much like the TLAM-D dispenses conventional munitions?

Dr. BARKER. I assume that by unitary warhead you mean "single" warhead and not a warhead carrying a unitary chemical agent. It might be desirable for a system carrying 500–1000 effective pounds of agent to hit multiple targets. However, we realize that this size may reduce the effective range of the parent delivery system. On the other hand, if the system produced is limited to less that 500 pounds of agent, we probably would not attempt to hit multiple targets.

POTENTIAL USE OF GLCMS FOR DELIVERING CHEMICAL WEAPONS

Senator QUAYLE. Might the existing GLCMs be converted into chemical delivery systems?

Dr. BARKER. I see no reason why existing GLCMs could not be converted into chemical delivery systems. Of course, we would have to develop and test the agent and warhead for converting (GLCMs) to a chemical role.

CHEMICAL WEAPONS DELIVERY FACTORS

Senator QUAYLE. Mission planning is a critical part of the Cruise missile launch process. Are there any additional requirements (e.g., factoring in the wind direction and wind velocity) necessary for the mission planning of a chemical cruise missile mission?

Dr. BARKER. Wind direction and speed are critical for any cruise missile system. This is especially true for chemical systems. Target area wind conditions can be estimated at launch. Ideally, for use against deep targets, the system could monitor winds enroute and adjust its delivery route to take advantage of the actual conditions on the target.

Senatory EXON. The hearing is adjourned.

[Whereupon, at 4:58 p.m., the subcommittee was adjourned, subject to the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

TUESDAY, MARCH 24, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SDI PROGRAM

The subcommittee met in executive session, pursuant to notice, at 2:06 p.m. in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Nunn, Exon, Levin, Bingaman, Gore, Wirth, Warner, Thurmond, Humphrey, Cohen, Quayle, Wilson, Gramm, and McCain.

Staff present: Arnold L. Punaro, staff director; Carl M. Smith, staff director for the minority; Gerald K. Bankus; Robert G. Bell; Robert F. Bott; William E. Hoehn, Jr.; Ronald P. Kelly; and Michael J. McCord, professional staff members; Colleen M. Getz, research assistant; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Gordon Kerr, assistant to Senator Levin; Edward M. McGaffigan, Jr., assistant to Senator Bingaman; Donald A. Mitchell, assistant to Senator Glenn; Leon Fuerth, assistant to Senator Gore; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; and Alan Ptak, assistant to Senator Gramm.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order.

I would first ask the staff to make certain that we are in top secret clearance in the room before we proceed.

Mr. PUNARO. We are ready.

Senator EXON. Thank you.

The Subcommittee on Strategic Forces and Nuclear Deterrence meets today for the 13th of its scheduled hearings. Today's hearing begins a three-part review of the Stretegic Defense Initiative.

The subcommittee meets today in closed session with Lt. Gen. James Abrahamson, the director of the SDI organization, as our witness. The subcommittee will also meet next Wednesday morning

in open session with General Abrahamson and Hon. Richard P. Godwin, the Under Secretary for Acquisition and the individual responsible for certifying the compliance of the SDI research program with existing treaties.

Following this, the subcommittee will hear testimony on the SDI next Thursday morning from outside witnesses. I hope that these three hearings will be adequate to develop a full basis for the committee's deliberations.

With that said, let me say "welcome" to General Abrahamson, and add that we look forward to his testimony today.

We meet today in closed session at General Abrahamson's request so that he can lay out the programmatic details of the SDI—where they are today, and what they would plan to do with the funds requested in the fiscal year 1987 supplemental, as well as the fiscal year 1988 and fiscal year 1989 budget requests.

At this point, without objection, I would like to insert into the record a letter that I sent to General Abrahamson describing the subjects I hoped that we could cover during today's briefing. Let me read the main paragraph from that letter for the record:

We would like first to present an overview of how the reductions to your planned fiscal year 1987 program were allocated given the shortfall of appropriated funds for fiscal year 1987. What was the rationale or strategy governing the reductions by line-item and project. Second, we would like you to compare the projected fiscal year 1988 funding levels contained in the fiscal year 1987 budget request to the actual levels in the fiscal year 1988 funding request, and explain the rationale or strategy underlying these differences. You should also indicate whether the strategy is also applicable to the structure of the fiscal year 1989 request. Third, the subcommittee would like to indicate what changes, if any, you would propose in fiscal year 1988 and fiscal year 1989 budget request if the fiscal year 1987 supplemental is not approved. Finally, we expect you to address fully the issues of near-term SDI deployment possibilities, to include weapons, sensors, battle management architecture, estimated effectiveness, survivability, and cost, and space deployment requirements, if any.

[The letter referred to follows:]

Lt. Gen. JAMES A. ABRAHAMSON,
Director, Strategic Defense Initiative Organization, The Pentagon, Washington, DC.

DEAR GENERAL ABRAHAMSON: On behalf of the Subcommittee on Strategic Forces and Nuclear Deterrence I am confirming the verbal invitation to you to brief the members of the subcommittee in closed session (not to exceed Top Secret) on March 24, 1987, at 2:00 p.m. in Room 222, Senate Russell Office Building. All members of the full committee have been invited to attend.

I believe this will afford you an opportunity to lay out the current status and proposed fiscal years 1988 and 1989 research plans for the SDI in greater detail than would be possible in open hearings. The subcommittee has a number of issues we would like you to address in your briefing.

We would like you first to present an overview of how the reductions to your planned fiscal year 1987 program were allocated given the shortfall of appropriated fiscal year 1987 funds. What was the rationale or strategy governing the reductions by line-item and project? Second, we would like you to compare the projected fiscal year 1988 funding levels contained in the fiscal year 1987 budget request to the actual levels in the fiscal year 1988 funding request, and explain the rationale or strategy underlying the differences. You should also indicate whether that strategy is also applicable to the structure of the fiscal year 1989 request. Third, the subcommittee would like you to indicate what changes, if any, you would propose to the fiscal year 1988 and fiscal year 1989 budget request if the fiscal year 1987 supplemental request is not approved. Finally, we expect you to address fully the issue of near-term SDI deployment possibilities, to include weapons, sensors, battle management architecture, estimated effectiveness, survivability and cost, and space deployment requirements, if any.

The subcommittee looks forward to your testimony with great interest and anticipation.

Sincerely,

J. JAMES EXON,
Chairman.

Senator EXON. I would hope that during today's session the members could focus on these areas, deferring questions about treaty interpretation and treaty compliance issues until next week's open session. Judging from his recent appearance before the Appropriations Committee, the General cannot, in an open session, go into detail on many of the issues of early deployment and the cost and effectiveness of early deployment options. That is one of the reasons I believe that General Abrahamson requested this type of hearing today.

The ranking member of the committee, Strom Thurmond, will be along shortly, and when he arrives at an appropriate break in the activities I will be glad to call upon Senator Thurmond for his opening remarks.

If there are no opening remarks by other members of the subcommittee at this time, we will go right to the witness.

Senator WARNER. If I just might make some observations, Mr. Chairman?

Senator EXON. The Senator from Virginia.

Senator WARNER. I think you have a very good program laid out for the subcommittee, and indeed the full committee was put on notice that they might attend.

I think it is wise that you have set a framework to comply with that. On the other hand, it seems to me the questions of what steps General Abrahamson would take as program manager if the broad interpretation were to be available, and when would he take those steps, and what would the cost implications be, are the appropriate questions within the framework.

Senator EXON. I said I hoped that we could focus on it, but there are going to be side issues that you can bring up.

Senator WARNER. Well, I think it is important that this committee have a record with respect to: What steps should be taken? When would he take them? And what are the cost implications to the program should a decision be made, and he be directed to proceed on a broad interpretation?

Also, my understanding, General, is that this committee, and indeed the Senate and the Congress, have tasked you with certain reports, some of which bear on these matters. Could you tell us during the course of your testimony when we might expect to receive those reports?

Senator EXON. I might say, Senator Warner, that I have no objections also to that type of question. What I was trying to do was to try and emphasize much of that that you requested would be classified, and I am sure the only way we would have a chance to get that is in closed session.

But I guess what I was trying to do was to try and keep this information, as best we could, focused on matters that can only be handled at a meeting of this classification. But that does not mean that we cannot get into other things; and if somebody wants to

open up with the General a full debate on that, that is their right as a member to ask any questions they want.

Senator Thurmond, I have given my opening statement. I will be glad to recognize you for any opening statement you might have now.

Senator THURMOND. Thank you, Mr. Chairman.

Mr. Chairman, I want to congratulate you for holding this hearing on the Strategic Defense Initiative. Today's closed hearing will afford us the opportunity to get into some of the technical details of the program which will not be possible in the open hearings planned later.

Mr. Chairman, as you know, I have been a strong supporter of the SDI program and of the President's desire to reduce our dependence on nuclear retaliation for deterrence.

The American people speak loudly in the polls of their desire to be defended. The program we will be hearing about today offers the promise of providing that defense in the future.

Mr. Chairman, I join you in welcoming General Abrahamson back before this subcommittee. The General has one of the toughest challenges in Government. From all I have learned about the work being done, I think he is doing a fine job.

General, we are very proud of what you have done so far, and we would like to encourage you all we can, and we want you to know we appreciate what you are doing.

Much has happened in the program since the General last testified. There have been greater than anticipated progress in several of the critical research areas. There has been a restructuring of the program because of budget reductions enacted by the Congress last year. There has been discussion within the administration with respect to a phased deployment approach.

Finally, there has been considerable discussion both within the administration and in the Congress on the conduct of the SDI testing program within the ABM Treaty.

We look forward to hearing the testimony to provide information that we will need to make informed decisions on the SDI funding level.

Finally, Mr. Chairman, I would note that much of what we have been hearing about the SDI program seems to be entirely consistent with the conclusions reached by all members of the Senate Armed Services Committee last year—namely, that the focus of the SDI program should be changed to provide more of a near-term emphasis. I want to thank you, and I hope as quick as we can develop the SDI we will do it.

I think it has done more than anything else to cause the Soviets to want to come to the negotiating table. Again, gentlemen, we are glad to have you with us.

Senator EXON. Thank you.

Senator THURMOND. Mr. Chairman, we are having a hearing up in Judiciary on oversight, and the Attorney General is probably there and I have got to go up there for awhile. I will come back as soon as I can.

Senator EXON. We appreciate and understand your schedule.

Please proceed, General Abrahamson, in any manner that you care to.

STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

General ABRAHAMSON. Mr. Chairman, and Members:

First of all, I thank you and I appreciate being back before this committee. I think that we have had over the years now—and it is nearly 3 years that I have been on the program—a very useful and a very interactive kind of discussion both of the purposes of the program, and the progress of the program.

I have found as we have gone through that, that we are having a great difficulty, and continue to have a great difficulty, in terms of describing exactly what it is that we wish to do. Therefore, I believe that the phased deployment discussions can illuminate that problem.

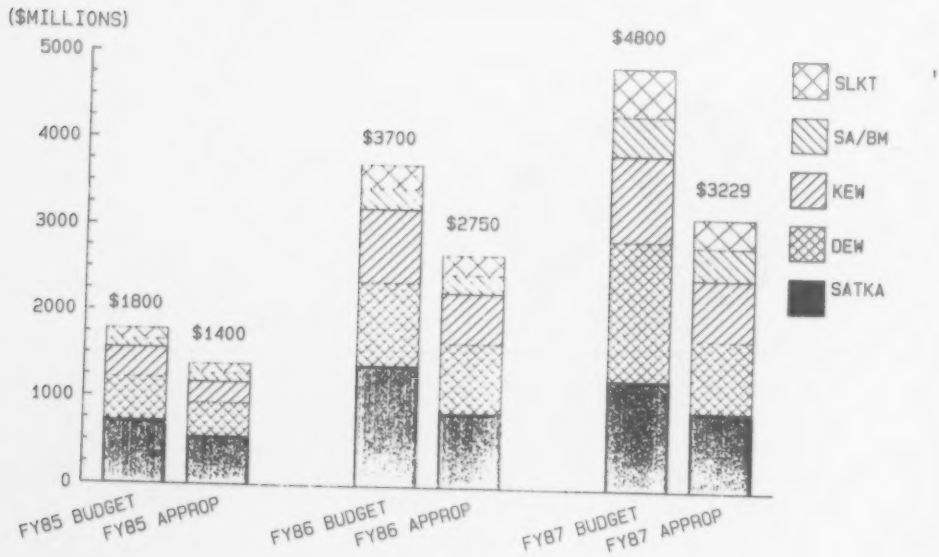
Now within the assignment that you gave us, which I think is a very appropriate one, I have tried to deal with it in several ways.

First, I have omitted any statement. We do have an unclassified statement that I think is most appropriate to be provided to the committee at the open hearing.

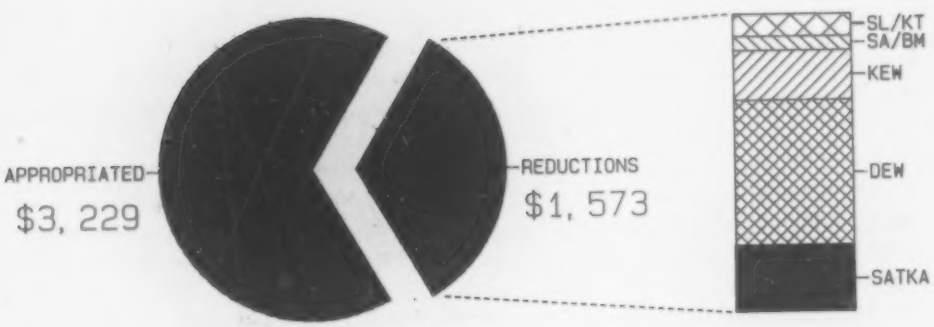
Second, I have provided two handouts. The first one is how in fiscal year 1987 we dealt with the very large budget cut, which was well over a third of the program. What that meant was a very, very substantial kind of cut that had to be made from what we planned.

[Handouts referred to follow:]

STRATEGIC DEFENSE INITIATIVE
BUDGET VERSUS APPROPRIATION



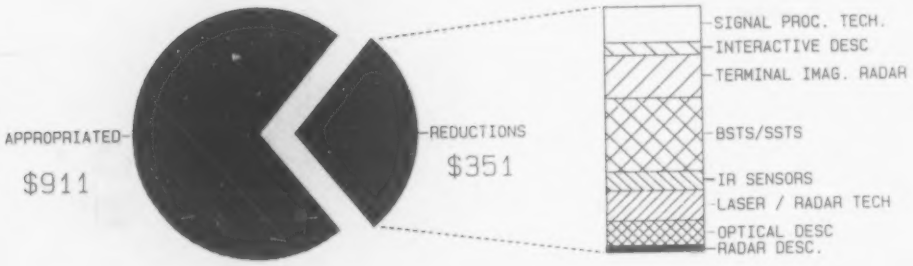
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
BY PROGRAM ELEMENT
($ IN MILLIONS)



FY-1987 BUDGET
$4, 802

CONGRESSIONAL
REDUCTIONS

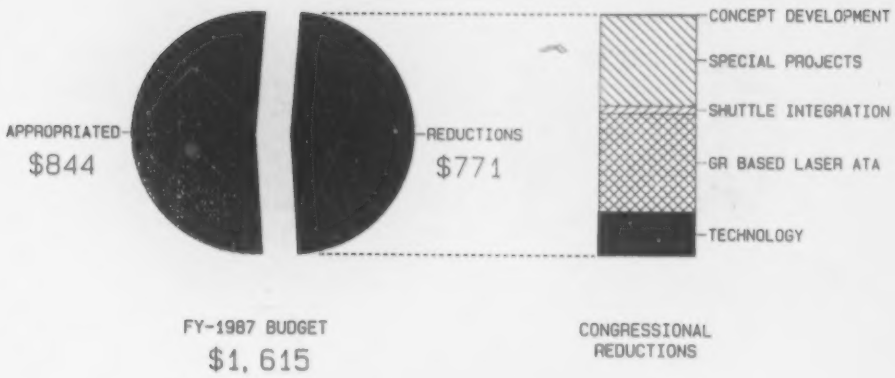
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SURV . ACQUISITION TRACKING / KILL ASSESSMENT
($ IN MILLIONS)



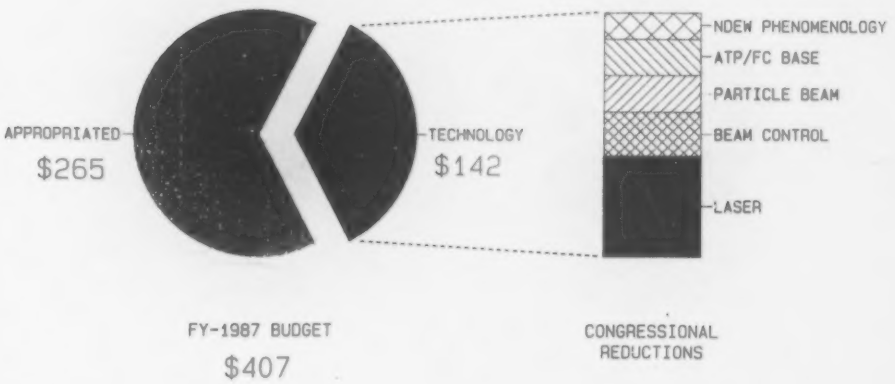
FY-1987 BUDGET
$1262

CONGRESSIONAL
REDUCTIONS

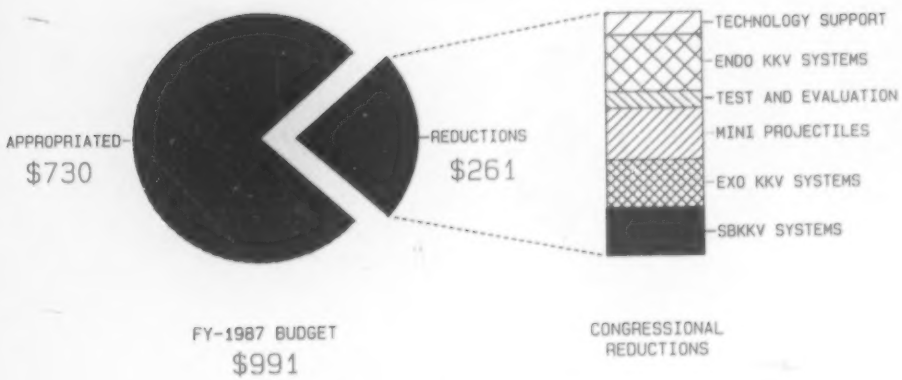
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
DIRECTED ENERGY WEAPONS
($ IN MILLIONS)



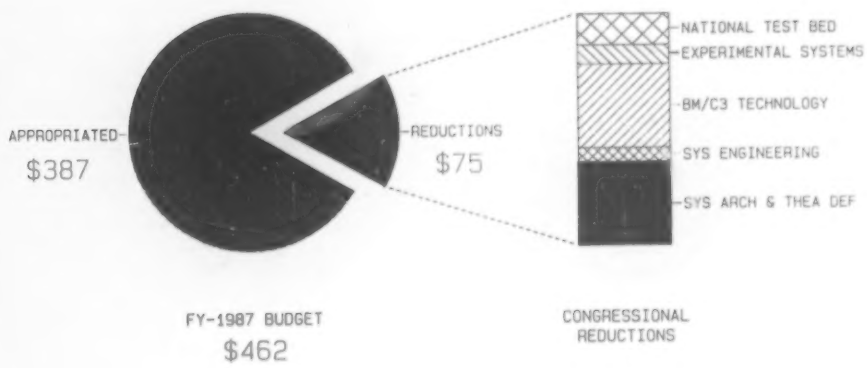
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
DEW TECHNOLOGY
($ in millions)



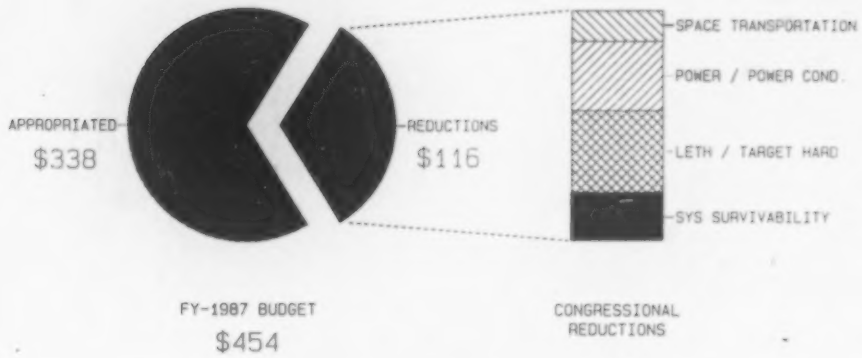
STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
KINETIC ENERGY WEAPONS
($ IN MILLIONS)



STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SYSTEMS CONCEPTS AND BATTLE MANAGEMENT
($ IN MILLIONS)

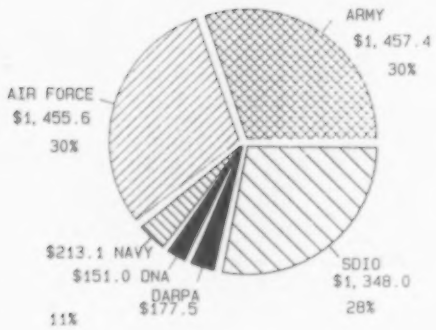


STRATEGIC DEFENSE INITIATIVE
FY1987 CONGRESSIONAL REDUCTIONS
SURVIVABILITY LETHALITY/KEY TECHNOLOGIES
($ IN MILLIONS)

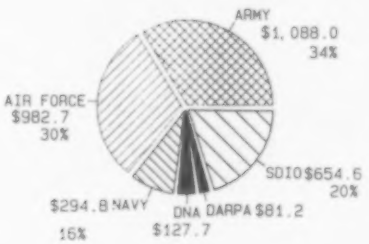


STRATEGIC DEFENSE INITIATIVE
FY1987 PROGRAM BY EXECUTING AGENT
$ THOUSANDS

FY 1987 BUDGET
4.8 BILLION



FY 1987 APPROPRIATION
3.2 BILLION



-1.6
BILLION

SURVEILLANCE, ACQUISTION, TRACKING AND KILL ASSESSMENT	FY86	FY87	FY88	FY89
RADAR DISCRIMINATION & DATA	21.0	12.7	22.6	34.7
OPTICAL DISCRIMINATATION & DATA	117.7	90.6	87.9	80.1
IMAGING RADAR TECHNOLOGY	30.5	26.2	32.0	38.1
LASER RADAR TECHNOLOGY	75.4	96.4	148.3	177.6
IR SENSOR TECHNOLOGY	82.2	78.7	93.7	98.8
BOOST SURVEIL & TRACKING	81.1	130.1	256.1	344.7
SPACE SURVEIL & TRACKING	49.0	47.6	191.8	242.2
AIRBORNE OPTICAL SURVEL	134.9	99.5	104.0	140.7
TERMINAL IMAGING RADAR	31.8	26.3	117.0	136.4
INTERACTIVE DISCRIMINATION	7.6	4.5	32.2	61.7
SIGNAL PROCESSING TECH	94.7	105.9	134.6	145.1
SATKA INTEGRATION & SUPPORT	95.0	149.6	248.0	311.2
COUNTERMEASURES	0.7	0.8	0.0	0.0
INNOVATIVE SCIENCE & TECHNOLOGY	25.4	42.1	24.5	48.4
SHUTTLE RECOVERY (memo)	0.0	13.6	0.0	0.0
TOTAL SATKA	847.0	911.0	1492.7	1859.5

DIRECTED ENERGY WEAPONS	FY86	FY87	FY88	FY89
TECHNOLOGY BASE DEVELOPMENT	435.5	339.7	340.5	408.6
ATP TECHNOLOGY	51.9	39.8	39.8	51.5
CHEMICAL LASER DEVICES	108.6	79.9	80.0	58.0
EXCIMER LASERS	39.1	12.4	12.4	30.0
FEL TECHNOLOGY	41.5	23.4	42.0	48.5
OTHER	93.1	27.0	32.3	28.0
PARTICLE BEAM TECHNOLOGY	34.8	38.5	57.8	46.0
SKYLITE	46.5	43.0	45.0	20.0
X-RAY LASER	20.0	8.0	30.0	25.0
RESERVE	0.0	67.8	1.3	101.6
TECHNOLOGY INTEGRATION EXPERIMENTS	329.4	402.1	587.9	646.1
ATP TIES	185.9	137.6	147.0	198.5
FEL TIE	84.8	158.0	158.0	201.5
SBL TIE	0.5	2.0	0.0	42.0
INTEGRATED SPACE EXPERIMENT	58.2	104.5	142.2	204.0
TIE ACCELERATION	0.0	0.0	139.2	0.1
RESERVE	0.0	0.0	1.5	0.0
CONCEPT FORMULATION & TECHNICAL	18.7	26.8	32.3	28.0
SUPPORT PROGRAMS	19.7	62.4	115.0	128.2
INNOVATIVE SCIENCE & TECHNOLOGY	0.0	12.7	28.0	35.0
TOTAL DEW	803.4	843.6	1103.7	1245.8

KINETIC ENERGY WEAPONS	FY86	FY87	FY88	FY89
SBKKV SYSTEMS	134.4	126.8	303.5	357.4
SBKKV EXPERIMENTS	117.2	107.0	250.7	305.7
SBKKV TECH	17.1	19.8	52.8	51.7
EXO KKV SYSTEMS	61.6	107.6	220.6	307.6
EXO KKV EXPERIMENTS	53.7	102.8	186.1	259.4
EXO KKV TECH	7.9	4.8	34.5	48.2
ENDO KKV SYSTEMS	76.7	111.3	237.6	238.8
ENDO KKV EXPERIMENTS	45.6	100.7	198.7	179.9
ENDO KKV TECH	31.1	10.6	38.9	58.9

STRATEGIC DEFENSE INITIATIVE
FY-1988/FY-1989 BUGDET REQUEST
PROJECT / TASK LISTING

KINETIC ENERGY WEAPONS (con't)	FY86	FY87	FY88	FY89
MINI PROJECTILES	56.0	74.5	102.9	134.7
EML TECH	32.4	16.1	14.4	32.2
LOW ENDO	18.7	53.2	76.4	82.6
LASER GUIDED HV PROJECTILES	4.9	2.0	6.9	11.9
ADV ENDO PROJECTILES	0.0	3.2	5.3	7.9
TEST AND EVALUATION	185.9	252.1	109.3	46.9
STM	174.0	176.4	63.1	0.0
RANGE INST/SUPPORT	0.0	18.0	10.6	6.0
SPEC INSTUMENTS/SUPPORT	0.0	4.1	2.2	3.6
TARGETS	9.8	14.8	21.7	21.7
HWIL AND SIMULATION	2.1	10.6	9.6	15.6
SPECIAL DATA COLLECTION	0.0	28.1	2.1	0.0
ALLIED/THEATER DEFENSE	69.9	44.3	72.9	79.2
THEATER MISSILE DEFENSE	69.5	39.2	66.3	68.4
INNOVATIVE SCIENCE & TECHNOLOGY	11.4	13.0	28.0	35.0
TOTAL KEW	595.8	729.6	1074.7	1199.7

SYSTEMS ANALYSIS AND BATTLE MGMT	FY86	FY87	FY88	FY89
SDI STRATEGIC ARCHITECTURE	63.5	58.4	91.0	78.0
SYSTEM CONCEPT ANALYSIS	21.6	28.0	41.0	32.0
ARCHITECTURE ANALYSIS	18.3	8.9	15.9	12.4
ARCHITECTURE EVALUATION	7.3	6.0	10.1	7.9
MISSION ANALYSIS	0.0	8.7	12.6	13.9
THREAT ANALYSIS	16.4	1.0	1.3	1.6
PROGRAM PLANNING	0.0	4.7	9.0	9.1
TECHNOLOGY REQUIREMENTS	0.0	0.0	0.3	0.4
SDII	0.0	1.1	0.8	0.6
SDI SYSTEMS ENGINEERING	12.1	20.2	39.0	53.6
INDUSTRIAL BASE	0.0	0.0	1.3	1.3
AFFORDABILITY & COST	8.6	6.5	9.2	6.5
LOGISTICS	3.2	8.3	14.1	11.4
SYSTEMS INTEGRATION	0.2	5.0	13.9	33.8
SYSTEMS REQUIREMENTS	0.0	0.0	0.2	0.2
SDII	0.0	0.4	0.3	0.4
THEATER ARCHITECTURE	1.7	39.8	38.4	37.9
ARCHITECTURE	1.7	39.1	38.1	37.6
SDII	0.0	0.7	0.3	0.3
BM/C^3 TECHNOLOGY	70.9	88.5	121.8	134.1
BM/C^3 TECHNOLOGY	70.9	86.7	120.8	133.0
SDII	0.0	1.8	1.0	1.1
BM/C^3 EXPERIMENTAL SYS	23.4	80.7	172.9	203.5
BM/C^3 EXPERIMENTAL SYS	23.4	79.2	171.5	201.9
SDII	0.0	1.6	1.4	1.6
NATIONAL TEST BED	12.0	60.6	119.2	228.4
NATIONAL TEST BED	12.0	59.4	118.2	226.5
SDII	0.0	1.2	1.0	1.9
COUNTERMEASURES	6.1	5.0	0.0	0.0
INNOVATIVE SCIENCE & TECHNOLOGY	13.4	18.1	28.0	35.0
CIVIL APPLICATIONS	0.0	2.0	2.0	2.0
MEDICAL FREE ELECTRON LASER	9.2	13.5	15.0	15.0
TOTAL SA/BM	212.3	386.9	627.3	787.5

SURVIVABILITY, LETHALITY & KEY TECH	FY86	FY87	FY88	FY89
SYSTEMS SURVIVABILITY	59.4	60.0	94.2	98.3
STUDIES & ANALYSIS	8.5	8.7	14.4	14.9
SPECIAL STUDIES	3.6	3.6	7.0	7.5
ADV DEVELOPMENT	46.1	46.3	72.0	75.1
PROGRAM MANAGEMENT	1.2	1.4	0.9	0.8
LETHALITY AND TARGET HARDENING	78.3	78.0	102.5	98.4
THERMAL LASERS	20.6	21.3	12.1	9.4
IMPULSE LASERS	16.9	12.3	30.9	29.6
PARTICLE BEAMS	5.3	12.0	17.7	15.5
KINETIC ENERGY	19.4	16.5	24.3	21.2
HIGH POWER MICROWAVES	13.1	2.7	0.0	0.0
LETHALITY VALIDATION	0.0	0.0	1.7	6.0
REP PLUSE PWR	2.0	10.4	14.5	15.3
PROGRAM MANAGEMENT	1.1	2.8	1.3	1.3
POWER & POWER CONDITIONING	50.0	85.7	158.0	186.9
TECH DEVELOPMENT	41.4	79.5	144.5	125.4
STUDIES & ANALYSIS	5.2	3.8	3.0	5.0
FLIGHT DEMO	0.0	0.4	9.0	55.0
PROGRAM MANAGEMENT	3.3	2.0	1.5	1.5
SPACE TRANSPORTATION & SUPPORT	20.7	36.4	433.8	606.2
TRANSPORTATION ANALYSIS	9.8	5.5	6.0	4.0
TRANSPORTATION ASSESMENT	0.0	0.7	2.2	9.6
TRANSPORTATION TECH	0.0	19.5	281.7	327.7
NASP	9.0	10.0	0.0	0.0
HLLV	0.0	0.0	140.0	260.0
PROGRAM MANAGEMENT	1.9	0.7	4.0	4.9
MATERIALS AND STRUCTURES	0.0	14.2	22.5	40.5
ADV DEVELOPMENT	0.0	13.1	20.6	38.3
SPACE STRUCTURES	0.0	0.3	0.4	0.4
REQUIREMENTS ANALYSIS	0.0	0.5	1.3	1.4
PROGRAM MANAGEMENT	0.0	0.3	0.2	0.3
COUNTERMEASURES	8.7	26.7	42.8	78.4
INNOVATIVE SCIENCE & TECHNOLOGY	0.0	18.2	28.0	35.0
HELSTF	0.0	18.8	18.5	18.5
TOTAL SLKT	217.1	338.0	900.4	1162.2
HEADQUARTERS MANAGEMENT	13.1	19.9	22.0	27.3
TOTAL RDT&E RESOURCES	2675.1	3229.0	5220.8	6282.0
MILITARY CONSTUCTION	3.0	10.0	125.0	18.0
TOTAL DEPARTMENT OF DEFENSE	2678.1	3239.0	5345.8	6300.0
DOE SDI PROGRAM	285.0	514.0	569.0	390.0
TOTAL SDI PROGRAM DOD/DOE	2963.1	3753.0	5914.8	6690.0

General ABRAHAMSON. That does not mean that all of us who are engaged in the program were not grateful and appreciative that in the fiscal environment that the Congress dealt with last year that you did offer us an increase. We understand that, and we appreciate that, and we have tried to do the very best with that increase that you offered us.

However, it was substantially less than we had planned, and that the projects were ramping up into. In page one of this budget appropriation, you can see how it is divided among the program elements. The first one is the support elements, then battle management, kinetic energy, directed energy systems and finally SATKA. So you can see how those cuts were made.

They are then broken out in terms of reductions in the next page in the more simplified pie chart. You can see that in fact a very substantial amount of the reduction was taken both in directed energy and in SATKA. However, that kind of cut could only be absorbed by taking cuts everywhere.

When we then go down further into each of the basic areas, you will see that for example in acquisition tracking and kill assessment, that several of the systems, the cuts were distributed through those systems. Then the subsequent pages explain again in each of the other areas where the cuts were taken, and how many were taken as we went into the fiscal year, and as we planned the fiscal year.

Now as we go through the fiscal year, there are modifications to this as we go forward. They are primarily based on, even though we have made an allocation, sometimes there are reasons that a procurement is delayed for example, just the job of getting the procurement out would cause that to be delayed.

Therefore, I have been very appreciative again of the flexibility that the committee has offered us, and that the Congress has offered us in terms of being able to make allocations, and make them throughout the year. This is too fast a reaction program, and the progress and the ability to take advantage of the opportunities as well as deal with some of the timing issues that come about through normal program management to be able to say that we will give you a frozen budget down to each project level, and that that budget can or should remain constant for the next fiscal year.

Therefore, it has been, again very useful to all of us to have that kind of flexibility.

Now as a fundamental strategy, when we made these kinds of cuts we had to consider not only what the program priorities were, we also had to think through what the contracts and the status of the contracts were.

For example, where there was an ongoing contract and we had a competition the year before, and that competition was a healthy one, and the winner of that competition had a layout on how fast he planned to go ahead, and his base price was associated with the speed and the expectation in funding, we had to consider those things as we made these cuts—not only the priority between long-term and short-term kinds of issues.

So, therefore, the dimensions of the strategy are: Where are the projects that are going forward very quickly and where the greatest prospect for strategic defense and cost-effective strategic de-

fense really are. Sometimes we can see that in the space of a year, we can see progress go ahead dramatically. An example of that is the free electron laser.

I talked about that last year, but it has dramatically improved this year, and I will comment on that.

The second kind of thing that we have to consider are our contractual obligations. Frankly, I also consider whether or not the team I have out there working the problem is really the right team, if they believe they can go do it, and they can produce the results we want. And in some cases, that is a factor even though priorities are very high.

Let me give you one example in this overall structure. You will see in SATKA where I have two important surveillance satellites. One is called BSTS. That is the boost system. [Deleted.] I will mention that briefly in my overall briefing that I deal with later on. That system is absolutely needed. [Deleted.]

We considered all of those needs beyond SDI. [Deleted.]

So we had to try to mesh those programs. Of equal priority to one of our toughest problems is the problem of separating and telling the difference between decoys and real warheads. That is a tough problem. The satellite that we eventually hope to be able to do that will be a lower altitude satellite, one that we call SSTS, space surveillance and tracking system.

We have had now essentially a study effort, and a series of tradeoffs, that has been going on for 2 years with that satellite. The answer that I got continued to be one that was unacceptable. It was a satellite that was too big, and too expensive, and I just stubbornly said I am not going to go ahead with that program until I get an answer that makes sense.

Now that took a long time to get that across to the aerospace industry who in fact spent money contributing in these areas, and frankly to my Air Force team that kept saying that this is the only kind of a thing that we can build. So that was not a matter of priority; it was a matter that I was not getting the answer.

When I finally got through and they understood that we had to have something that was going to be a different scale and that was going to be workable at another scale, now I am beginning to get answers, and in fact in the fiscal year 1987 budget I have a much smaller amount that is dedicated to restarting that effort, but frankly a very different scale than we started on.

So the strategy had to consider each of those things.

For the fiscal year 1988 budget, I have summarized here the extension of these down to what we call the project level, and it lays it out into fiscal year 1988 and fiscal year 1989 so that you can begin to see the continuity of some of those. We would be willing of course to go into detail on any one of those, but since there have been these questions you have raised about phased deployment and about the relationship of fundamental technology to some of these systems, I felt that the committee could understand better if, instead of trying to deal with over 2,000 contracts and projects out there, if I took a more in-depth look at a few contracts and show how it is that the technology program runs into a system program—and the progress we are making on some fundamental and important questions such as survivability and how we are trying

then to focus in a cost research program to ensure that we meet the criteria, not only the one of cost-effectiveness and cost-effectiveness at the margin, but the additional one that I brought out last year many times that no matter how all of those come out, it must be an affordable option that the Nation has.

So what I tried to do was, rather than deal in depth across the entire program, is to try to take a slice and use that to illustrate particularly the relationships to phased deployment.

Now obviously I will be willing and will try to answer questions, detailed questions, on the overall program, but I believe this is the best way to get a broad understanding of what we are doing.

Senator EXON. I appreciate your presentation. If there is no burning desire to start with questions now, I would suggest it would probably be best if we held our questions and let the General proceed with the rest of his presentation. Is that satisfactory with everyone?

Please proceed, General.

General ABRAHAMSON. First of all, in terms of objectives, this is the same objectives chart I've been using since the beginning. The President has not sent to me a new directive of any kind. We are still operating with exactly the same objectives that we had right from the start.

SDI PROGRAM OBJECTIVES

- CONDUCT A COMPREHENSIVE R&D PROGRAM TO DEVELOP KEY TECHNOLOGIES FOR DEFENSE AGAINST BALLISTIC MISSILES
- CONSIDER OPTIONS TO INCREASE THE CONTRIBUTION OF DEFENSES TOWARDS DETERRENCE
- PROVIDE THE BASIS FOR AN INFORMED FULL SCALE ENGINEERING DEVELOPMENT DECISION IN THE EARLY 1990s
- PROTECT OPTION OF A NEAR-TERM DEPLOYMENT OF A LIMITED ABM CAPABILITY AS A POSSIBLE RESPONSE TO SOVIET ABM BREAKOUT
- EMPHASIZE NONNUCLEAR KILL MECHANISMS
- COORDINATE SDI WITH OTHER DEFENSE PROGRAMS AND SUPPORT OTHER STRATEGIC DEFENSE MISSIONS

I would point out that there is one to protect an option for a near-term deployment as a possible response to a Soviet ABM breakout. I think it is important to realize that an SDI response is not the only response that any administration, either this one or a future administration, might consider.

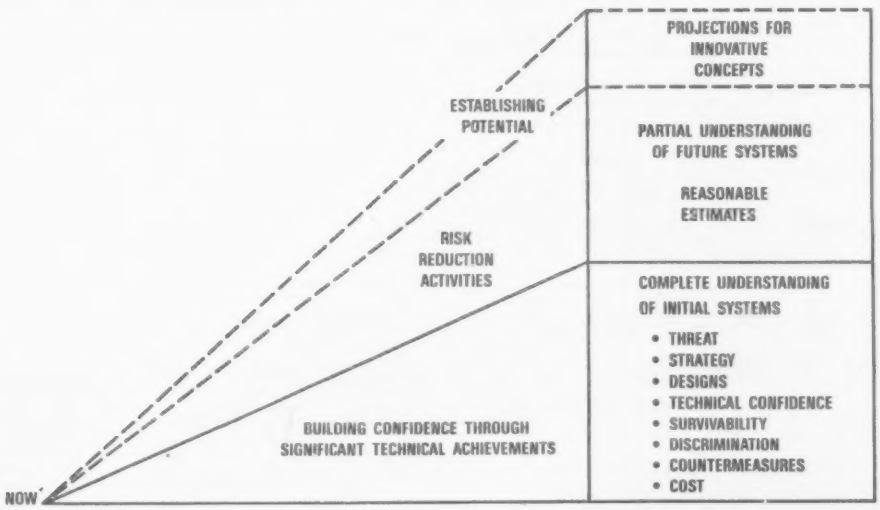
They certainly might consider offensive responses, political responses, diplomatic responses, a whole range of responses, however, I do have a responsibility to define how far away we might be from one of these near-term options in order so that if they chose an SDI type of response. We could see whether or not that was realistic and what that might mean.

The next one that we get confused on many, many times is nonnuclear kill mechanisms. Remember the appropriation for SDI was $3.2 billion. That was in the President's DOD budget. There was an additional appropriation of approximately $300 million that was in the DOE budget. That was necessary because, under the Atomic Energy Act, DOE is the appropriate place for nuclear testing and nuclear-related systems.

Some of the system work associated with the implications of that is funded under the Department of Defense budget, but we very carefully work with the DOE to ensure that we meet the intent of the law in the separation of those two efforts. Because we wish to accelerate some of those efforts, we went through a very long and a very complex process in order to properly go through the congressional transfer process last year. Frankly, it was a discouraging result. It took so long that I think the people who understood the priority and the effort were discouraged that the process is just not responsive, and I agree with them.

In terms of the other points here, there are no changes at all. Next slide, please.

DEVELOPMENT DECISION CONTENT



- MAJOR POLITICAL DECISION
- FIRST OF SEVERAL

Now there has been so much discussion about deployment and about phased deployment that I would like to make this point. In the future security strategy study that was done at the same time that the Fletcher Commission looked at the overall program, there was a recognition that the natural way that such a system that is so dramatic and so complex and so large, that it would develop piece by piece; that there would be mature technologies that would come along first, and that there would be other kinds of systems that would come along later.

So that the idea of phased deployment really first appeared in the Future Securities Strategy Study, and that was published even before my office was put together. We recognize that, and this is a chart that I put together and used, not very successfully by the way, in some committees and with many individual members. You will notice that it was at the time that we are talking about the fiscal year 1985 budget. What I was trying to do was to break out and show people the fact that there are mature technologies, and that this goal that the President has set is a very demanding goal. Even in his speech of March 1983 he said that you would not reach that goal perhaps for decades.

But these mature technologies would in fact take you part way along the way, after an overall decision of some kind, and at that point we try to take some of the technologies and divide them into how much that we saw that we were being worked and invested in in initial or mature technologies things that we understand and that we are building on, such as missiles. We know that. We know how to do that. We have done it for a very long time.

Later on, some of the more advanced systems that can deal with countermeasures and that would be highly cost effective, and finally, even some of the innovative things downstream.

That was a pretty good balance when we requested these kinds of numbers. It has been unbalanced since that time, but I tried at that point to introduce the concept of a phased deployment. One thing that was missing was an explanation of what the specific system that we are talking about is.

But I also tried to relate it to what I thought was going to be the character of the decisionmaking process. Here we were early in the process beginning to build confidence through technical programs risk reduction activities, but I saw that the national decision that we are going to make was one where for those initial systems—and I did show this not only last year but in the latter part of the season before that. Notice this is a November 1985 chart—where I thought that for the initial system we would have to know in great detail all of these issues: the threat, the technical confidence behind them, the countermeasures, cost, all of those issues.

And in the Department of Defense, which is going through the DSARC process, now redesigned and called the DAB process, and this would be the equivalent of a milestone two kind of portion for that part of the program.

I saw that national decision, and obviously I am just trying to look ahead, that the Congress and the administration at that point would indeed determine how this decision was going to be made, but this was my view of it at that point: That even though that decision might be available on the initial systems, that there is a

very important relationship between that initial system and how far and how fast some of the advanced technologies might be coming along, because you would want to, when you make that decision, at least have some reasonable understanding of what is coming and some confidence about these things so that you know that when you make that first step you are not stuck at that first step, and in fact you can naturally go into that second step.

You know that there is risk involved, that there is additional development that has to be undertaken, but in fact when you make that you want to know you can make that step with some reasonable level of confidence, and in fact you would like to look ahead, even though you do not know all of those details for some of the very innovative things, the very high-powered directed energy systems that might come along later.

So you would like to know that there is a path out there that is going to get you to this thoroughly reliable goal that the President has outlined. Those relationships we consider to be extremely important not only for a deployment phase and a concept with which you approach deployment for an SDI system, but also for the way in which you approach arms control negotiations, the way in which you approach the political process of making that decision, that all of that is very, very critical.

Now those are old things that we have talked about. I do not blame many Members of the Senate and the House because we perhaps did not talk about it in great detail, and because much of the debate took place around what could an eventual system do, which I thought was very interesting but in fact very highly theoretical, and what were we spending the money on.

I can see that some people did not focus on this process of how one gets there. So last year when we continued to get questions time and time again that said, are you defending missiles, or are you defending people, then it became clear to me that even though we have talked about the long-term objective, that it was important to begin to fill in the planning for how you get to that long-term objective, because I could not see that that was—that we just flat could not answer that question credibly.

In fact, we were urged by members, and we do have a report which, I feel terrible about, but which is overdue, about some of those early kinds of systems that might explain how you go into a phased deployment, what it means, and whether indeed you are defending missiles or people even in that early process.

So we started last year to begin to try to relate the maturity of our technologies to what could be done in terms of mission accomplishments, to get down to more concrete levels. That has taken a lot of work, and we are not done with that process, not done at all.

However, I believe that at least we have the kinds of strawmen that are available so that right now what is going on is that the Joint Chiefs and the service staffs, are examining the strawmen that we have laid out for a phased deployment so that they can then apply their military judgment and consider whether these kinds of missions are worthwhile so that you start a phased deployment, and it is a thin deployment, it is not fully capable, is the mission itself that goes with that, is that worthwhile all by itself, instead of just being something that you can technically do.

And if that is worthwhile, then it is a worthwhile step at some point, always building, always stepping toward the President's long-term goal, and I think is the thing we have laid out in the long term here.

[Chart deleted.]

So what we have done now is we have postulated missions for a partial system. Here you can see some of those missions. They are not full and complete defense, but they represent a military step that we hope has value. That process of how much value, and relating that to the number of systems and to the cost of that, is ongoing. It is not yet complete.

You will notice that a partial capability has really several important elements. Even though it may not be able to protect the entire population as this long-term objective can, if it can affect the initiation of their time line, if you can restrict their options so that perhaps even it may make, by adding a defensive component to our present offensive deterrent, or even if we are optimistic and hopeful, a reduced offensive deterrent, that we end up with a higher level of stability in the near term; and we have restricted enough of their options that it makes sense to go ahead and deploy such a system.

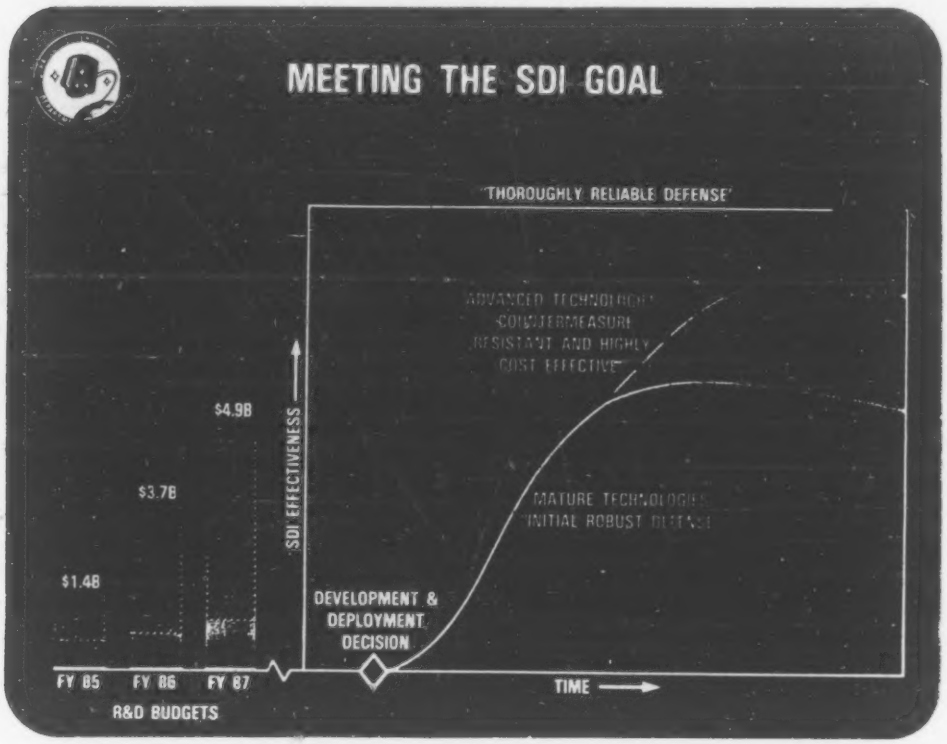
By the way, it does not make sense to deploy that for the United States alone. We have to be able to go forward in the theater with our allies at the equivalent rate. That does not mean that the absolute percentage of effectiveness must be the same, but there has to be a coordinated way in which you go forward. Otherwise, we leave our allies vulnerable, and in the end that leaves us vulnerable. Therefore, I believe that what we have postulated is a series of missions that make sense, and I will show you then and comment on what kind of an architecture goes with that, and how that then begins to build up to a point where a long ways from a perfect defense you are at a level where now with virtual target protection at much higher levels, perhaps 80 to 90 percent effective, then we really can have a major part of our deterrent failure come from defenses, and a much smaller part come from offenses.

So this is a logical way, logical from a technology maturity viewpoint, and also from a military viewpoint, to say let us begin to build up defenses as we begin hopefully to build down on both sides offenses, always continuing to work for this very, very effective defense in the long term.

So that is what we mean by phased deployment. The process is not complete. It does not necessarily mean early deployment. That is a separate kind of policy decision that a President either now or later will make. But no matter if it is early or late, that is the natural way in which this kind of a system will proceed. It will proceed that way because you just cannot put it up all at once. It does not make sense.

And by the way, from an operational viewpoint you have to take separate steps. You would like to have the experience of putting up something, and beginning to operate with it for awhile. In the military business, you do not just build the most advanced airplane ever. You build in steps on the airplanes that you have had in the past. The same thing with submarines, tanks, all the various weapons.

So you would like to get the experience in that first system, and then begin to fold that into the improvements and the changes that you make in the second system. And finally, both in arms control, but also in the way in which you look for and deal with the Soviet response, we think that this offers us a strategy of what I call branching and blocking. I think that that is very important, that in fact deployment eventually when the decision is made must be an important part of a research program.



For example, if this deployment is built around spaced-based interceptors in the beginning because those are the mature technologies and the easy things to do, but you know that directed energy weapons are coming and are coming at a reasonable timeframe behind it, then hopefully by the time you have started that deployment you can demonstrate the effectiveness of some of the directed energy weapons.

[Deleted.]

So you are providing every motivation possible to say, do not spend that money. If they do not spend that money, then we may not have to spend the full deployment amount [deleted] provided that you have progressed far enough in the research program that you have confidence that you are inside their deployment time line; [deleted] you have your directed energy system mature enough so that you can indeed say I can deploy that, and deploy it as quick or as quickly as we begin to see Soviet systems go out in the field.

So it is part of the strategy to persuade them, just like everything else about SDI. Remember, at least my view of SDI is that what the President said in his speech in March 1983 was to come up with a different strategy, a different set of technologies, and hopefully a more productive approach to arms control, hooking that very carefully to an economic strategy, and I feel it has to be hooked very carefully to a deployment strategy, as well, in order to use every lever available to try to change their fundamental behavior. And that is the way we are trying to execute the program.

Now with that as an introduction, I would like to step into the one area of technology, and go in depth so that you get a better feeling for how we are doing.

[Chart deleted.]

The first generation. There have been lots of different kinds of proposals, and some of them have a great deal of merit. One of the proposals is a proposal that says let us put 100 interceptors out within the ABM Treaty, and we can do that. I have personally been crawling around the holes up around North Dakota. I have visited and talked to the people who have done that, and we could for a fairly reasonable price tag put not the old kind of terminal system that we rejected back in 1972, but we could put some of the Eris missiles out there, and we could have a very light-area defense over the United States, very large.

That was looked at, and the judgment was made that that military contribution, while it may have some merit, perhaps does not have enough merit to divert the research program and the money that you are putting into the research program, into that kind of a deployment. Therefore, we ought to look at the next level that makes sense.

Now remember what some of those missions were that I talked about. They were to try to interfere so directly with the Soviet ability to time an attack and to reduce some of their limited nuclear options, then the architecture that goes with that is absolutely vital and critical, and a terminal defense is not going to have very much impact on being able to get increased stability or to put at risk and make them see that the value of some of their military offensive systems, [deleted] that that makes sense.

So we felt that a reasonable architecture—now this is a strawman that is being examined—is one that has at least two layers. I said that last year. I felt that a proper start is a place with at least two layers so you get the benefit of this process of forcing them to think through what are the probabilities of getting through not one layer, but two.

The one that is the most valuable is a boost-phase layer, and it happens to be the one where the technology is fairly straightforward. That does not mean we are there yet, but it is fairly straightforward.

Therefore, we think that we get the most leverage from the boost-phase system. But you have to give them something else. Therefore, the Eris kind of technology, which is a ground-based system, is an area defense, not a terminal defense, which gives you a boost phase and a late mid-course.

So then the question is, OK, how far along and how mature are those kinds of technologies? Of course the JCS looks at that and

says, will that really produce both the levels of uncertainty and force them to be in a situation where they cannot in fact control the escalation process, and where they cannot just pick any kind of attack that they want.

[Chart deleted.]

So then the candidate systems for a first generation. And these are candidates. This is not a decision process that is complete, at all. But again it is the natural kind of one because of the maturity of these systems, if there is a need or military merit. For boost-phase, the space-based interceptor. That is coming along pretty well, and I will try to explain that.

Remember, now, that is just a simple rocket like this. Here is one contractor's kind of view of this thing. It may be a little bigger, or it may be slightly different, but the point is that is something on the order of complexity of a Phoenix air-to-air missile, maybe twice that, but not 3 times, or 10 times. It does not require breakthroughs in terms of basic physics, anything of that kind.

The cost relationship between this kind of a system, [deleted] it is beginning to be quite apparent, although there are infrastructure cost items on both sides, the infrastructure for this are the garages that it sits in, perhaps about a [deleted] that might carry up to [deleted] of these kinds of systems.

In addition to that, you must have an improved surveillance capability in order to provide the initial information to this that says there really is a strike coming. You take over for these particular systems. This knows where it is, and it tells each of its missiles, it says, you take the one on the left, you take the one to the right. It is a very decentralized, very simple kind of battle management and control approach in that system. [Deleted.]

So what might be this simple apparent kind of cost relationship begins to be a litle bit more complex. It gets even more complex when you begin to think through what can the Soviets do to respond to these things? And I will try to address that later on.

We demonstrated ERIS in June 1984. What we demonstrated was that it is technically feasible. I made that comment, and I did not say, last year, I did not say that we know that it is cost effective, that we know that we have dealt with all of the other kinds of things, but we know the technical capability of hitting and destroying with nonnuclear means a warhead in space.

Now the job is to make it small and affordable and inexpensive. So again, that cost effectiveness ratio really works.

Now that is a long ways away, and you know that one of the things they are going to do is they are going to put decoys out there. So you have to be able to get something since, remember, I said that one satellite just was not paying off. I just was not getting the kinds of results that I wanted from that system.

So we will probably build a small number of these probes which are [deleted] or other kinds of [deleted] sensors that you can put up slightly ahead of these for the last system, and use these to see at a much closer distance in order to make up for that distance. Remember, that is [deleted] miles away.

So this allows you not a perfect ability to handle all the decoys in a mass raid, but enough that they have to think through this problem, and they do not have a simple, easy solution to ensure

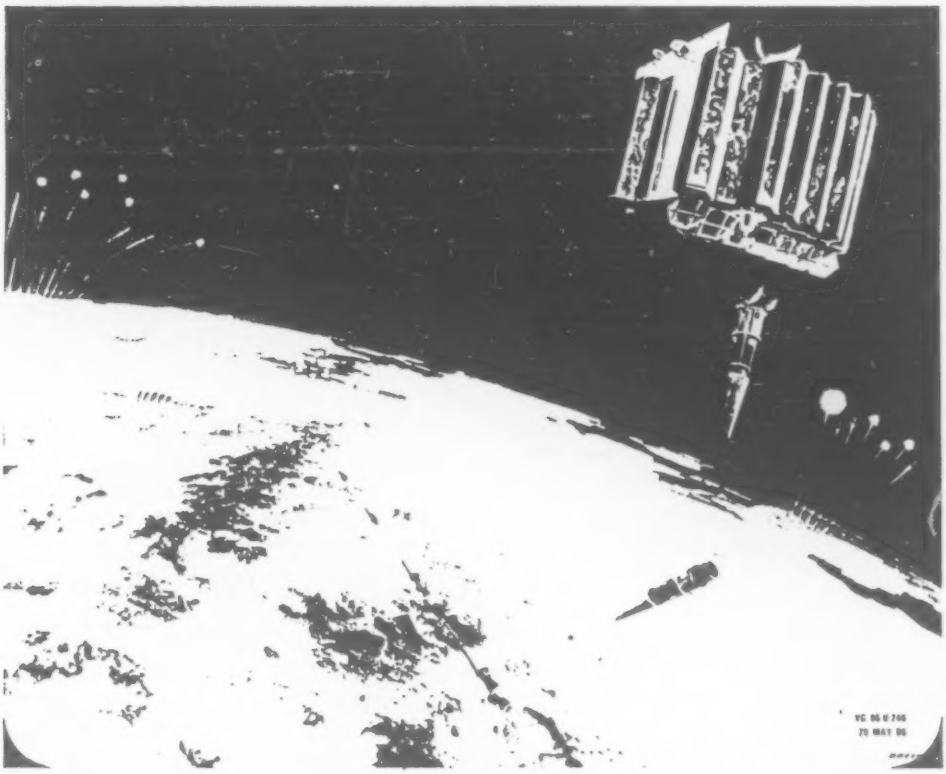
that they can, No. 1, blast a hole through this one and, No. 2, counter all of those.

But it is not intended, a first system, to be a fully-capable defense of the entire country and the population. It is intended, once finally defined, to be able to have a logical contribution to deterrence and stability.

The next reasonable question is, how mature are these technologies? How far along are we on some of these? So I would like to take an example, because I think it explains the structure of the program and how we have been approaching it, including our acquisition and business strategy. That is a fundamental part of this overall effort, the business strategy.

I would now like to go back and lay out some of the overall programs. We have been approaching the space-based interceptor here.

SBKKV



Remember, this has no warhead. [Deleted]—but it destroys just by being able to see very carefully and [deleted] on the way up in the boost phase, or to be able to do the same thing in the post-boost

phase. So it is a dual player. It is kind of a switch hitter that can go in both boost and a post-boost phase.

[Deleted.]

So we have been investing in technology, small unit things. I will just show you a few of those, but I have a book to pass out to everybody that goes in much more detail, but I would like to just comment on a few points.

[Chart deleted.]

When considering the space-based interceptor, remember you have got to be able to see in the front so you can maneuver. Therefore, we have several contractors putting together different kinds of focal plane arrays, the eyes for such a system. And we tested them on a bench, on an optical bench, and in ways in which we can see that they are working.

Some of these are miniaturized, some are not. Here is a front end head for one of these kinds of systems, but one that is designed in a very special way. This is one by Rockwell, [deleted] and the intent is to deal with this problem of countermeasures.

One of the things that I will talk about later on is a nuclear explosion. If a nuclear explosion goes off, not only is there a signature, is it the right altitude in space—and by the way, this is an unknown area; we do not know a lot about it yet—but there is also some prompt radiation, and you want to ensure that that does not come in here and [deleted].

So this is designed very carefully with only a [deleted] so that that explosion must be within, or a portion of it, must be within [deleted] of where this is looking. This is also true for a laser, if they want to use a laser as a countermeasure. Otherwise, they cannot stop it. So we are trying to build in at the component level the kind of response so that you can deal with countermeasures.

Now this is a big one, but we have tested this again in a chamber and on various benches in parts of the systems. Those mirrors, if they are mounted here—here is a very perplexing kind of a problem, and it is the kind engineers love. But remember, this thing slams in with a side acceleration when it makes its correction coming in here.

If that tremendous impact on the side of this thing causes whatever your focal plane is here to make a big jump, and it causes you to breaklock. Remember, I developed the Maverick missile, and I know what it means when I say breaklock. What it means is you are aiming right for the tank in the Maverick, you breaklock, and you miss. Well, a miss for one of these things, even if it is a small miss, is you have lost the ballgame.

So we had to come up with ways in which those side accelerations will not be a problem to you. One way is a [deleted] we have proven that it works, and we can take a big bang on the side.

[Deleted] and that is in my book, where you accept the bang on the side, and just the brains of the system correct for what happens there. We have tested that.

Here we have tested the focal plane readout. [Deleted] we have actually put together the [deleted]. Now this is part of the command and control problem that many people say is impossible. What we are doing is, we are distributing the problem all the way

out to components all the way along, and testing those, and testing them ahead of time.

Those are just some examples.

[Chart deleted.]

However, there was still [deleted] from last year. If you recall, I talked about that. We do not [deleted] as it goes out in space. Remember, if any of you have been to a shuttle launch or any of our other launches, you know what it looks like when the fire and the smoke comes out in the atmosphere.

Well, when it is out in space, [deleted]. And we did lots of things to try to understand it. We did measurements in firing in a chamber down in Tullahoma, TN. We got airplanes out, and we were taking long-range pictures of the system, but finally we had to get real information in space, and that was our Delta 180 experiment.

[Deleted.] I could go through the whole mission as I did with some of you before. Senator Gore and I went through it in great detail ahead of time, because he properly wanted to know, are we doing something that really will break the treaty.

I hope, sir, that you were convinced that we did not, and that we are not, because they were cooperative. The importance of that mission and that intercept was not that we crashed into the target. The importance was that in the process of crashing into the target we saw microsecond-by-microsecond exactly what that target looked like right up to the very end when we hit it. That was the key. And there was cooperation between the two elements of it.

[Chart deleted.]

Here, it was part of the system. By the way, we did that, and I am so proud of that team, we put that test together around a table in my office, and then we did it 14 months later. That is one of the most complex space missions that has ever been run. From a data-handling viewpoint, it was tougher than the first space lab mission that I was in charge of where we put tons of data down, because we had to do real-time control from various elements that just did not exist at the time. We put Kwajalein together with the Air Force space track NET, with the NASA NET, and fielded the real time data back there. We had to write a million lines, a little under a million lines of code.

We did that in 6 months, and it worked perfectly for that system. Now what did we find out in this step? Dramatic information. [Deleted.]

Now that may not mean much to you, but it sure means a lot to those of us who asked them to put this system together. [Deleted.]

[Deleted.] I do not know yet because, as always, you see one of these things and you say, let us go out and get some more data. That is always their response, and in fact we do need to get some more data.

But the fact that [deleted].

What it really means is we gained confidence in our entire system as we went forward. Now I said that we were doing tests in chambers in order to do plume measurements, and that kind of thing has been going on throughout the program. But I have been anticipating. We are going to do these things in parallel.

What this thing is going to see, because remember its job is to hit the missile, not the plume, so we have had another team that has

been out developing that end-point algorithm, and they have developed that in such a way with both solids—and this is all in a simulator—but we have developed the software and tested it, and we have developed it so the eyes will look at this overall pattern here and begin to decide what that pattern looks like, even if there is some variability in that pattern.

[Deleted.]

The way you deal with that is you have algorithms [deleted] that can accept some variability. So we had to do two things. We had to have the right algorithms, and we know that we can do these. We have tested them on simulators now.

We also have to have confidence in terms of seeing real things, and we need to see some more of those. But the point is, these are examples of some of the kinds of things that are going forward on the program. That is the technology program.

One of the ways you increase the kill radius is that you do not put a warhead on, that is too heavy, too expensive. What you do is you put, and we are working on, [deleted].

Once again, unlike the Union of Concerned Scientists who are off writing their equations and making these assertions about what we are doing, we passed them so long ago we are building the real thing. [Deleted] then to model those and put them in the computer so you do not have to just test all of them time after time, but to have a cost-effective way in trying to understand those relationships—not only those kinds of things, but [deleted] are built in fundamentally different ways with composite materials. We have got to do the tests for those kinds of items, too.

So the point is, we are [deleted] and, while we do not have all the answers, and I will not assert that we have all the answers yet, we really have a level of maturity that is coming along very, very fast for these kinds of systems.

What does that mean in terms of an overall strategy in how we go along with the program? I have talked about the technology program that has been underneath all of this. We have had contractors in one of my horse races where, without putting a lot of money into them, they have been laying out the architectures of what they think are the specific requirements, how fast does it have to go, what is the field of view, or the narrowness of that kind of a system, what kind of agility, side powers, do they have to have? And, giving us conceptual designs.

[Chart deleted.]

We have now passed that point. We have got all that, and now we are narrowing them down where we are picking the good runners in this horse race. My RFP is on the street now for the next phase.

Now this is going to get expensive. We can fool around and waste money on more conceptual work, but in order to make progress now it is time to move out into a flight experiment. The business management strategy that I have, because I do not know how much money I am going to have, if the history of cutting the program goes on the way it has, is that I put one flight experiment to build pretty close to one of these systems. It is not a development of one of these things. We are not giving it all the characteristics of

a fieldable weapon system, but I have got to know that I can get down to the size and shape, and test that real-time in the system.

So we select one person, or one contractor, for a flight experiment. We will do a couple of flights. At this point, some are around here in 1990 or so the test results are available. But we bring them along with the system concept and integrate all that technology so that the development system coming along behind it is getting the benefit of all these kinds of systems.

Now I don't want to select one contractor and be stuck there. I still want competition in this program. This is not as expensive as the development phase which is going to come later. So if I have enough money, we will bring along contractor B. I will not allow them to be able to build this expensive part of it, but you will have them work out on the integrated technology and the system contract work, so when that phase three decision comes on and we select one of these guys and get an initial contract for the development program, I have really got competition that works there.

Now we have to have a business strategy. In some cases I cannot make that work all the way, but I am trying to do that so we minimize it as we go later in the program.

The next one, please.

SPACE BASED KINETIC WEAPON SYSTEMS (SBKWS) FUNDING

(FISCAL YEARS)
($M)

	86	87	88	89	90	91
SBKWS EXPT.	44	58	203	240	195	110
SBKWS CONCEPTS AND INTEGRATED TECHNOLOGY	73	50	48	66	162	278
ADV. TECHNOLOGY	17	19	53	51	65	72
TOTAL	134	127	304	357	422	460

Senator EXON. General, could I interrupt you for just a moment?

General ABRAHAMSON. Yes, sir.

Senator EXON. We have a rollcall vote on. Are you anywhere near the end?

General ABRAHAMSON. This is a good break point now, sir. I will just point out that the funding on this program, like everything else, got cut this year, even though we are going into the next phase of the program. It did not get cut terribly, but it got cut just like everything else.

However, we were at a critical point in the program, and I just could not cut it down to zero, or cut out 30 percent, but it is about to go into a very expensive phase. That is why I needed the competition, and it is ready to go into that expensive phase because it costs a lot to do space experiments, as well as begin to develop the process.

This is a good place to break, sir.

Senator EXON. We will recess for 7 minutes so we can all go and vote.

[Recess.]

Senator BINGAMAN [presiding]. General, why do you not go ahead and continue with whatever you had to say, and Senator Warner and Senator Wilson and I will hold down the fort until some others arrive.

General ABRAHAMSON. Well, I am sorry, and I hope I am not giving you a picture of building a watch.

Senator WARNER. Building a what?

General ABRAHAMSON. Building a watch, sir, telling you how to build watches. I hope that that is not what is coming across. But what I am trying to show you is that there is reason and logic down into great depth down into every one of those programs.

However, I was concentrating on one, and I just want to spend about three and four charts on one other. Just to point out that it is not merely the near-term efforts that we are concentrating on in making progress.

I will just take some samples from one of the other programs that I think is absolutely critical. That is, the free-electron laser. Now that is clearly a phase two kind of system. It is coming along later, but remember I said it is imperative that we be able to have a proper relationship between the time at which that can really be deployed and initial deployment. It is coming along very, very well.

[Chart deleted.]

For example, there are really two competing concepts in the free-electron laser. One of them is called the induction linac version. This is the one that is being worked primarily at Livermore. We now are in the process of completing experiments. One of them we call PALADIN.

The importance of it is that we have now the key element which is a wiggler. We have gotten through with that wiggler first light, and we have amplified that system. We are at not quite the frequency range we want, but we are very close to it. We have jumped a huge amount.

So the point that I am making is we are making a great deal of progress with this particular experiment, as well. That is only one of the two competing approaches to the free electron laser.

[Chart deleted.]

The other kind is one that we call an RF version. That one is driven by radio frequency energy. Here we have at Stanford, with the support of TRW, we have achieved visible lasing. What does that mean? We got down to even below the frequency that we would like to get to. So we have demonstrated that for that particular kind of system, that the free-electron laser will allow us to get to the frequency we want. For scientists, that is called a scaling concern, and it was a very real one. But I think we have demonstrated in less than a year that we are really trying to kick off a lot of these things that are worth tackling. We have not solved all of the physics problems, but we are tackling them, and we are reaching important milestones.

In this particular one, the RF version of the free-electron laser, there has been equivalent kind of progress out at Los Alamos where we are demonstrating the ability to be able to recover the energy, and by doing that get to much higher efficiencies.

There is a completed one at Boeing that we do not have quite all of the power out yet, but we are making progress. So the key point I would like to just bring out is that by emphasizing this kinetic version and talking about that in depth, please do not get the impression that other parts of the program which are equally or in the long term are maybe going to be even more vital, are not making equivalent kinds of progress, but they are different problems.

That is an engineering problem. This is more of a scientific problem. The key point is, it is coming along, and coming along very well. We had to cut back on some of the funding more than we wanted. We wanted a dramatic increase in this funding.

We have cut back. But in directed energy in general, we are still spending more money than we are in kinetic energy, and therefore trying to maintain as well as we can the balance between longer-term types of systems and shorter term.

Now every team that is out there will say, I am not getting all the money that I ought to have, and that is true, because every team believes they have got the right answer, and that is exactly what I want them to believe. That is the kind of team that you want to do the job. So I am very pleased with that, as well.

SURVIVABILITY

Now I would like to move into survivability. I would like to talk about survivability in the context of what might be a phase-one kind of deployment, whenever that occurs, and in some of the systems we would have to operate against.

[Charts deleted.]

[Deleted.]

OK, the co-orbital ASAT. [Deleted.]

[Chart deleted.]

Next, please. Now considering that those are the kinds of threats that we have to deal with, very often our critics will get up and they will say: "Well, you know a satellite comes ripping along in this same orbit all the time, and all you have to do is just hit it." Frankly, that is pure hog wash. It is a lot more complicated than that.

I would like for you to begin to understand at least some of the kinematics of the problem. I apologize if I take a little extra time, but I think that it is valuable in light of the fact that I keep hearing this time and time again: Well, there is a satellite; we can knock it off.

What they have to do, if you are going to deploy these kinds of systems, and there are several different altitudes that you might consider. The lowest is about [deleted] and that is [deleted]. It is quite different than geosynchronous orbits.

[Chart deleted.]

I will show you what these orbital configurations might look like, [deleted].

They could, without a tremendous expenditure, but it would be some expenditure, bring into time somewhere in perhaps the second half of the—maybe earlier, if they really went after it—but somewhere in the latter half of the 1990s. They could make some changes to this in order to, without fundamentally changing the boost operation, they could go faster by offloading some of their weight, and by getting systems in place that [deleted].

[Deleted.]

So the first point is that the first one is going to be able to intercept this on the way if it is today's booster, or even today's class of booster, and will be empty by the time the first ASAT gets up to where it is. It is kind of like targeting empty silos out there, and that clearly is a problem.

Now you want it to last a little while, because it has some other functions. But so long as the functions of the carrier vehicle can be replaced or acted on by other carrier vehicles here, command and control functions, relay functions, and an update; update is about [deleted] out. So the last time the carrier vehicle talks to one of those on the way out its target is just [deleted].

Now they might say, well, let us give up on that one. Let us take some of the other ones that are coming later on for their system. They in fact, some of the later ones with today's technology, and again this can change [deleted].

Now that is real warning. That is an unambiguous warning. That is instead of a portion of our [deleted.] So there are those kinds of issues in terms of timing that begin to operate for such a system.

So their problem now becomes a tactical strategy problem of how do I pull off a surprise attack? They could get out and destroy one or two of these, but it is just like a formation of airplanes. It is not one or two you have to deal with; it is many.

[Chart deleted.]

[Deleted.] This is where they deploy them, ideally, and this is where they have to compromise if they want to stay within the Soviet border.

[Chart deleted.]

OK, here comes your line of satellites, one plane of these kinds of systems, and they are separated by about [deleted.] This is the satellite coming down. If that satellite is in the right zone, that is the kill zone for it.

[Chart deleted.]

But even if they have destroyed that one, remember there is a whole bunch of them in a line coming down. Only a few of them are going to be in the battle. That one will be well out of the battle. However, it can shoot backwards and begin to defend some of the other satellites.

But it is not just one line coming down that way, it is another line coming up this way, with redundant coverage as you go forward.

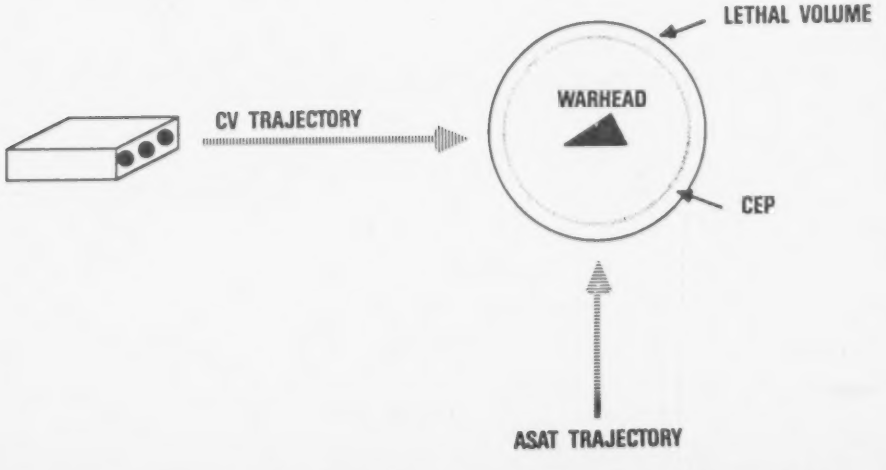
[Chart deleted.]

And it is not just two of these planes, it is a whole series of these planes. So that what happens, if they are successful in destroying one or two of these, there is a short period of time that the orbits heal themselves over the Soviet Union. This is a dynamic problem that is a very difficult problem to deal with.

[Charts deleted.]

That does not mean they cannot, but coming from the ground with ASAT attacks is a very different problem. [Deleted.]

ONE ON ONE ATTACK–1



OK, now let me go back to the 1-on-1 situation because I want to build up the economics of one of these things. This is just a symbolic representation of a carrier vehicle, and you have a lot more of these in them.

Remember, I talk about an ASAT that would come up, and it might be a nuclear ASAT as it comes up. The CEP for a conventional one is a very small CEP. They have really got to be accurate. They have got to blow it up right on that trajectory. This is why they might very well move to a nuclear system.

The size of the lethal volume depends upon of course the yield of the warhead. [Deleted.] There is some advantage to using that kind of a system.

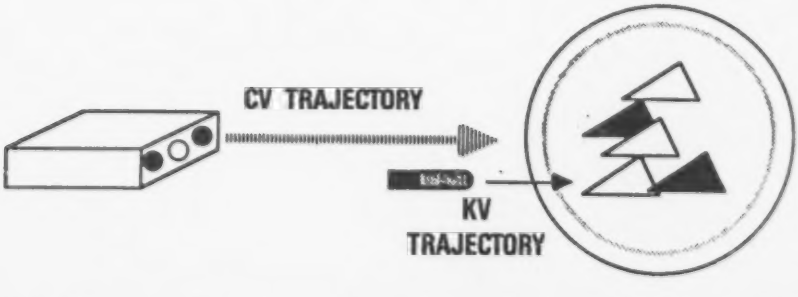
The way it kills, is that as this goes through the radiation, it destroys either the optics on board, or the electronics on board and/or if there is enough of a radiation blast, it actually in fact affects some of the outer skin of the system.

So if they just use one warhead, remember there is a lethal volume and that changes with the size of the yield of the system. One of the things they know we can do is we can shoot back. You can shoot back at the ASAT on the way up, or if you miss it there you can shoot, and if you have the capability to designate that or in some way to say that is the warhead you can go off to that warhead.

Now what have they done? They have depleted part of your ammunition stock, but they have not destroyed anything yet. If you can destroy that, they have to think about that problem. So what is the obvious response on their part? Well, let us put two of the warheads up and maybe a few decoys as one goes through. So they might do a few decoys as one goes through. So they might do something in putting—[deleted].

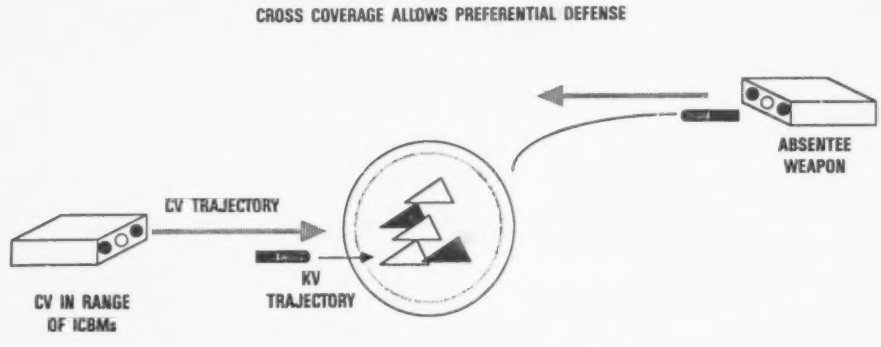
ONE ON ONE ATTACK–2

SHOOTBACK FORCES MIRVs AND DECOYS



But it is not just that one that is going to be killed. It is one that is out of position in order to get far enough to be able to destroy a booster on the way up, but it can come back and also shoot at some of these. Now not many of these can, but a few can.

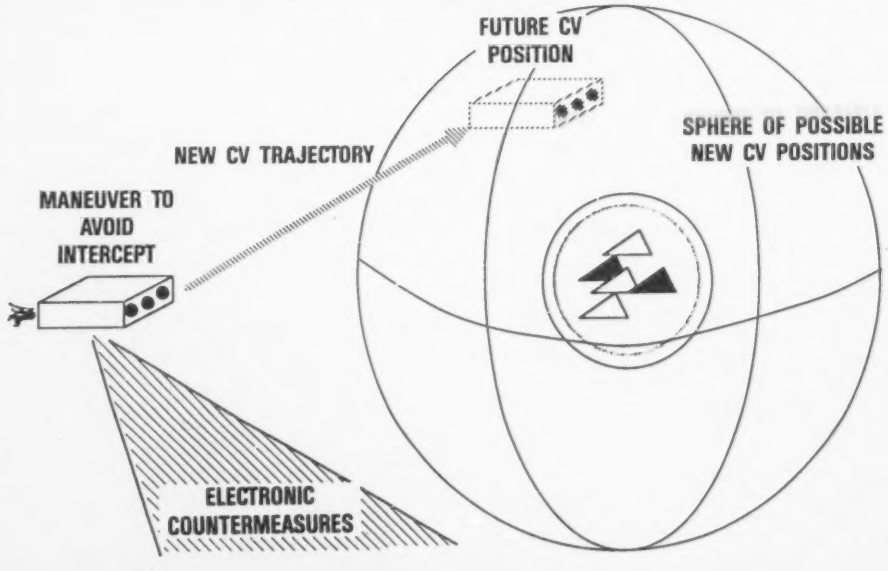
ONE ON ONE ATTACK-3



Now if this can maneuver, their problem gets very much more difficult. If they plan that carefully because they have been tracking this day after day and they know that is happening, and remember here your key is the guy who moves last has got the big advantage, and that is at this point the defenses.

He has got to plan for what is your volume that you can maneuver into. He does not know that, exactly. So now we are introducing uncertainty, but he knows it is something that you can maneuver.

MANEUVER PLUS ECM TO AVOID INTERCEPT



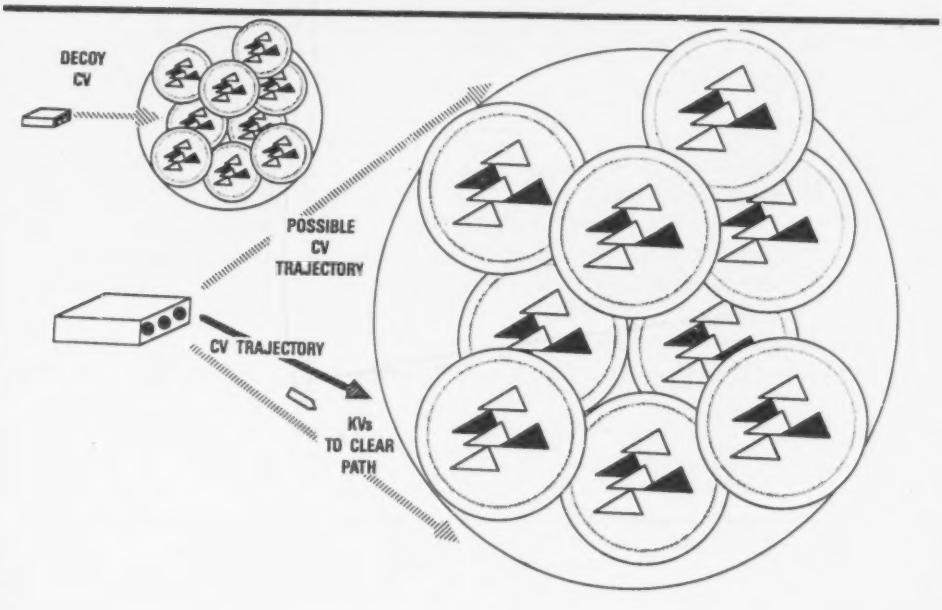
I have left off electronic countermeasures.

So now he has to begin to blow up not just one, but a whole bunch to cover that whole sphere of action as you go through. And

if you have—remember, if he can use decoys, so can we, and I think that is very important. They are not terribly expensive—they are expensive, but they are not as expensive as the real system.

So if you put up some real ones and you have decoys that look just exactly the same, he does not have to put up just a few to cover your sphere and your maneuvering sphere, he has to cover many spheres here.

MANEUVER AND DECOYS FURTHER RAISE PRICE TO THE ATTACKER



Now we have tried again to say, what is the proper tradeoff for these systems in order to make them survivable as you go forward. [Deleted.]

This economic balance is not the same economic balance when you begin to put in tactics and some bright engineering into these systems, as the critics who get up and say well here it comes and we are just going to knock off that one when you describe the process. It is a very different process.

[Chart deleted.]

[Deleted.]

TECHNOLOGIES

Optics;
Focal planes;
Signal processors; and
Surface protection.

Now are we making progress in hardening? Well, that is an important element in the kind of progress that we are making. I will just talk about the things that are susceptible to that kind of an attack.

[Deleted.] Finally, a few years ago the JCS put out a specification that said we ought to do some hardening for those satellites.

[Deleted.]

[Charts deleted.]

Here is an example that applies not only to the optics that might go on a carrier vehicle, but also the optics that might go on a high-altitude system. [Deleted.]

[Charts deleted.]

How have we done it? Well, I have talked to you about gallium arsenide as a new kind of circuits. Frankly, that is coming along slower than I like, although we are making some gallium arsenide circuits. They are fairly simple circuits at this point in time. What we have done is we have another program where we are building on the DOD VHSIC program. Remember, that is the very high speed integrated circuits. We are trying to take that technology, make it hardened. We had competition between five different folks out there and compared them in testing, and selected two of them. Those two are going forward and building hardened circuits so that they can then go into our signal processor so that they can eventually work.

[Chart deleted.]

Focal planes. I talked about this last year. The same problem. [Deleted.] We came up with a whole new concept for building these things called impurity band conduction. What really is very, very thin layers so that the radiation goes through it. Here is what happens with a normal infrared focal point. You put a little radiation on it, and the background begins to get all wiggly, and is not very good. The signal, if you put a signal out there and detect that, starts at one level but both the background and the signal vary over time in the radiation environment, and you cannot rely on how much that is going to happen. So your senor just is not reliable.

With impurity band conduction, it stays the same. Now that is not the total answer, and it has not solved everything, but we are solving it electronically in combination with this, and that really is important.

This is only one of three areas that I call breakthroughs. The three areas that I think we have had breakthroughs in are this, second, being able to compensate through the atmosphere at low power as we demonstrated over a year ago in Hawaii, and third, progress in the free-electron laser. These are the only things that I call breakthroughs.

Senator THURMOND. What was the last one that you mentioned?

General ABRAHAMSON. The progress in the free-electron lasers. I think those are really just fantastic steps forward for all of us.

Now the other things I have described are important bricks, important progress that we are making. The press, every time I describe one of these things, says that I have made some kind of a breakthrough, and I am not. I am saying that this is good, solid engineering work that is going to make the difference.

[Chart deleted.]

Laser radiation shielding. Remember, I talked about some of the things on the ground that can get us. Shielding a satellite is a different problem than shielding a missile, [deleted.] Remember, getting a laser up through the atmosphere and not having a cooperative system to work with in order to help get it all up means that

there is still a problem. We have not solved that, yet, but we are working on it.

Here is an area where we have made really [deleted.] It is not enough to handle a very, very powerful laser if it has a cooperative way of getting through the atmosphere and then can strike, but we believe it is enough to add a great deal of survivability to a satellite, and we can always make it thicker if we need to. It is light, and it is not heavy.

[Deleted.] Well, that is one-kind for our satellites. We are also concerned with what they do, or what they might do, in terms of laser armour for one of their systems. So here are some of the tests that we have done with our very high power—it is our only high power system, the MIRACL laser out at White Sands. [Deleted.]

What we have found is, it is pretty susceptible today. We have got some advanced things that we put out where [deleted] here of exposure to that high-power chemical laser which will not be as powerful or as potent as the free-electron laser waveform when that happens, we were able to begin to burn through this quite easily.

Now what is the conclusion of all of that? The conclusion is that I think [deleted] and that it is harder with these kinds of systems to in fact [deleted].

That does not mean that some bright people working with some of these other concepts, or maybe putting them in combination, might not be able to find a way. So I do not have the final answer yet in terms of those systems.

That is one of the reasons we are driving for very high-powered lasers.

I will try to finish this section here.

Senator LEVIN [presiding]. General, about how much longer is your presentation?

General ABRAHAMSON. Sir, it is just about 5 minutes.

[Charts deleted.]

[Deleted.]

The Russians have recently said one of the things they can do [deleted]. Space is a big place.

Now they could go to much larger systems, and we probably cannot survive a strike against a much larger system than that. That is not my intent. [Deleted] and if we can handle many small systems the probability that they can hit us with a large system is very small. So we are working on those kinds of systems we have demonstrated, [deleted].

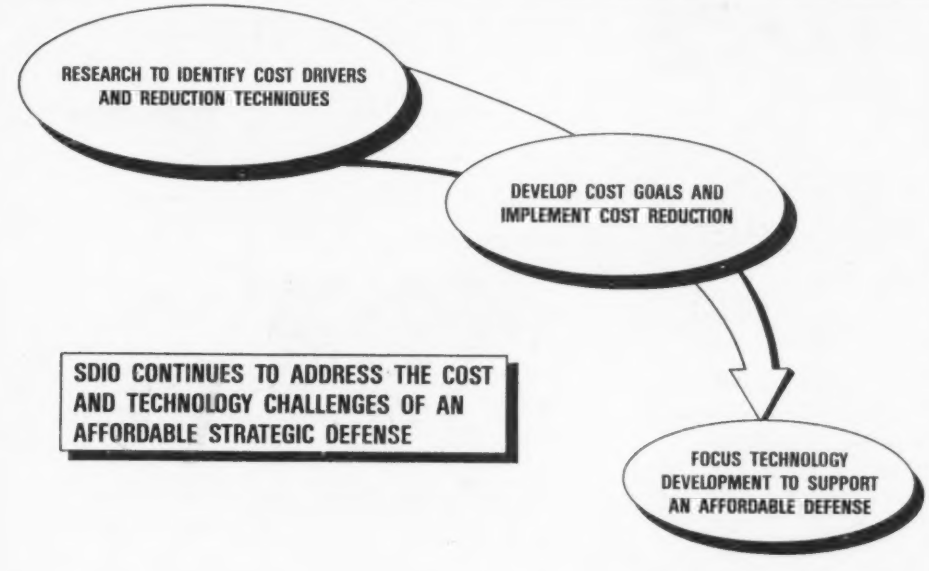
Again, please do not misinterpret that we have got all the answers, we do not. But we are making, I think, a great deal of progress. The survivability question is much more complex than the simple assertions that the critics make.

COST EFFECTIVENESS

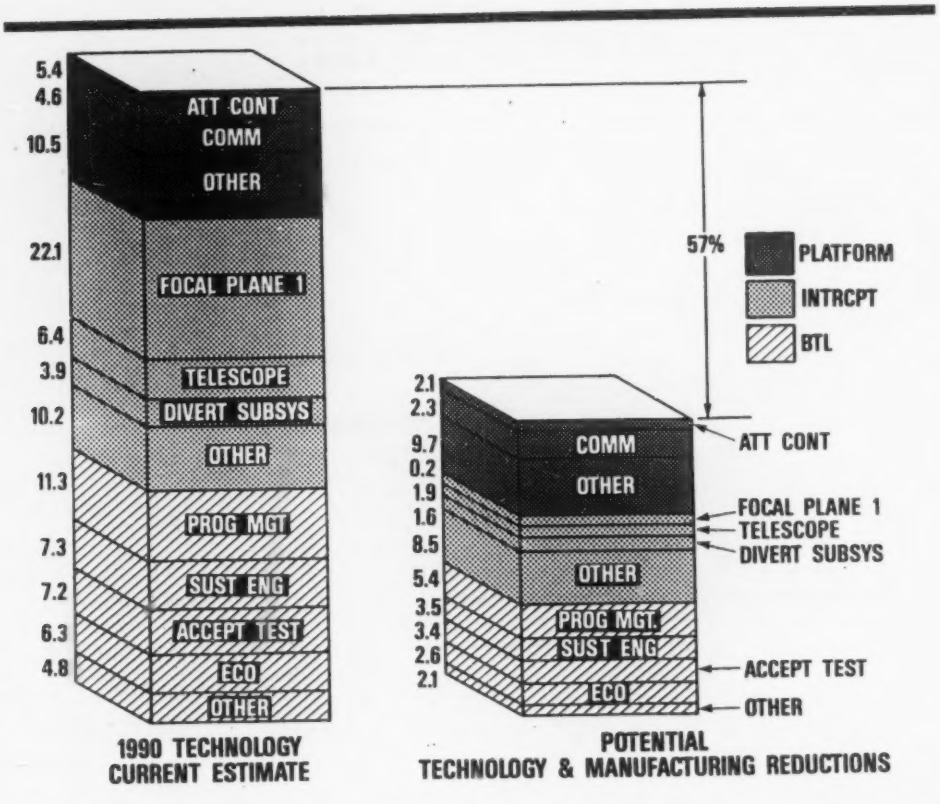
Let me start with the last portion of this, and I will not spend much time on it. Just so that you understand that we have an important cost-effectiveness research program that is going along with all of this.

This is not just to see what technology is available. For example, this is a technology effort. When we take something that on today's satellite is that big, and we make it this big for our system, that is going to be a lot less costly, but it is primarily a technology effort.

AN EMPHASIS ON COST


RESEARCH TO IDENTIFY COST DRIVERS AND REDUCTION TECHNIQUES
DEVELOP COST GOALS AND IMPLEMENT COST REDUCTION
SDIO CONTINUES TO ADDRESS THE COST AND TECHNOLOGY CHALLENGES OF AN AFFORDABLE STRATEGIC DEFENSE
FOCUS TECHNOLOGY DEVELOPMENT TO SUPPORT AN AFFORDABLE DEFENSE

In addition to that, we are doing research on how to build something in the future better than we have done it in the past and really do it right. So we are trying to identify the cost drivers for these systems, develop the goals that I talked about last year and how those might in fact be implemented, so that we can be assured that we do have an affordable defense.



Let me give you an example, and there are more--I do not have these across every system yet, but we have gone out and tried to study the cost drivers. This is a space-based interceptor, and these are, using estimates, and it is estimates, against the 1990 kind of technology.

Where are the costs? You can see, for example, 22 percent of it is in that focal plane. So one of our important efforts, that tells me, is to really go to work on focal plane. We have sent people out and examined how we make focal planes today. What are the cost items? How are the companies even put together. It is not just for the direct cost, but also the indirect cost.

BUSINESS AS USUAL FOR FOCAL PLANE ARRAY PRODUCTION

THE CURRENT ENVIRONMENT REQUIRES A HIGH PROPORTION OF ENGINEERING/DESIGN PERSONNEL

	PERCENT OF TOTAL LABOR
• ADMINISTRATION/SUPPORT SERVICES	20
• PROGRAM MANAGEMENT	5
• SYSTEMS ENGINEERING/DESIGN	40
• FABRICATION	5
• ASSEMBLY	10
• PRODUCT ASSURANCE/QUALITY CONTROL	10
• MANUFACTURING ENGINEERING	2
• INDUSTRIAL ENGINEERING	2
• MANUFACTURING SUPPORT	2
• PRODUCTION CONTROL	2
• TOOLING	2
TOTAL:	100%

INDUSTRY DATA

Here is a typical company and the percent of the manpower in that company, and you can see that a lot of it is in the administration and some of the engineering, and only a small amount of it is really in fabrication. So what we want to be able to do is to put together companies that can make the systems that we need that are tailored to what we need, and you do not have to do all this engineering that you do today when they make up a small batch for a small system of satellites.

So we go out, we study the fundamentals—and there are not many companies that build this today—in order to do it not the way we are doing it, but the way it ought to be done.

SBKKV TOP FIVE COST DRIVERS AND APPLICABLE REDUCTIONS

TOP FIVE COST DRIVERS	% OF TOTAL	WHY A COST DRIVER	COST REDUCTION TECHNIQUE	% RED
SENSOR FOCAL PLANE	22.1	• MODERATE-LARGE NUMBER OF DETECTOR ELEMENTS • CRITICAL TECHNOLOGY UNCERTAINTIES • NUCLEAR HARDENED • EXTENSIVE TESTING	• SEMI-AUTOMATED IA&T (YIELD << 1%) RATE PRODUCTION IS THE KEY ISSUE • MANUFACTURING TECHNOLOGY YIELD IMPROVEMENT • DEDICATED PRODUCTION LINE • SEMI-AUTOMATED IA&T (YIELD 2% TO 5%) RATE PRODUCTION IS THE KEY ISSUE	15–30 90–99
SENSOR TELESCOPE	6.4	• HIGH PRECISION FINISH • EXTREME WEIGHTING • NUCLEAR HARDENED COATING • PRECISE OPTICAL ALIGNMENT (IA&T)	• DEDICATED SEMI-AUTOMATED PRODUCTION LINE AND IA&T FOR GLASS • DEDICATED SEMI-AUTOMATED PRODUCTION LINE AND IA&T FOR BERYLLIUM	20–40 50–70
PLATFORM ATTITUDE CONTROL	5.4	• PRECISION COMPONENTS (E.G., IMUs) • NUCLEAR HARDENED • COMPLEX ALIGNMENTS (IA&T)	• AUTOMATED PRODUCTION OF SOME COMPONENTS (E.G., REACTION WHEEL) • DEDICATED PRODUCTION LINE, SEMI-AUTOMATED IA&T	30–80

Here is where we have identified cost drivers. I will not spend a lot of time on them. Obviously they are in finding yield improvements, new ways to pick those out of the production line, finding automated ways to proceed on that focal plane, and then a dedicated production line so that you do not spend all that time and overhead for those kinds of systems, because you are going to make thousands of those things eventually.

So I guess the key point that I am making, and I will stop with that, is that a part of our program is to make the whole thing affordable in a way that we can indeed have real options for the Nation as one goes ahead.

With that, I will stop. You have been very, very patient, and I know that is a long effort, but I am trying to give you a feel for the depth of the program, and the way we are approaching it. I could give you a similar story across any one of the technologies or the line items. In some cases it would be more complete; in some cases, it would be less complete.

Thank you for being patient, and I will answer your questions.

Senator LEVIN. General, thank you for your presentation. I know Chairman Nunn has to leave in a couple of minutes. Let me yield to him in the event that he has a question or two.

Chairman NUNN. I do not think I have got time to get started and to follow through, so why do you not go ahead.

Senator LEVIN. General, I understand from our staff that we are going to be having a hearing on April 1 on the issue of SDI and ABM compliance.

General ABRAHAMSON. Yes, sir.

Senator LEVIN. And you will be back at that time?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. I am wondering if you might submit to us prior to then a list of experiments and tests that you have scheduled for 1987 through 1988, and as to which ones of those, if any, are presently configured, or could be configured, in a way which would bump up against the traditional interpretation of the ABM Treaty? If you could get us that in advance of the April 1 hearing, we would have something that we could think about and talk about before we ask you questions on that. Will you be able to get us that list?

General ABRAHAMSON. Yes, sir.

[The information follows:]

SDI EXPERIMENTS AND TESTS

All SDI experiments and tests are currently configured within the restrictive interpretation of the ABM Treaty. In our joint appearance before the subcommittee on April 1, Mr. Godwin will present a list of SDI experiments planned for fiscal year 1987 and fiscal year 1988. For a more detailed examination of what SDI programs would look like under the legally correct interpretation, I would direct you to the classified report to the Congress on the Anti-Ballistic Missile Treaty, or Wallop report, delivered to Congress on May 19, 1987.

General ABRAHAMSON. I would like to point out that there are hundreds of tests that are small that are not at issue, and I would not like to try to pull all those together.

Senator LEVIN. I am interested in the tests which could either be planned——

General ABRAHAMSON. The answer right now is that there are none that fall in that category. The fiscal year 1988 budget was put together in such a way that all of the test planning is only within the narrow interpretation of the treaty.

Senator LEVIN. Are there any which could be reconfigured?

General ABRAHAMSON. I can show you one of those right now.

Senator LEVIN. I really do not want to get into that.

General ABRAHAMSON. I can show you one of those right now, if you would like.

Senator LEVIN. I do not want to get ahead of the game here. If you are coming April 1, all I wanted was a list in advance so we can think about it.

Senator WARNER. Well, I do not think we want to discuss the treaty, whether it is broad or narrow. That is an important subject for a later date, but I think as program director he should advise the committee that. OK, if I were to shift, if my Commander in Chief said shift, then this is what I would do.

Senator LEVIN. If it is not a long answer, please proceed. Chairman Exon is not here, and I do not in any way want to impinge on what he has scheduled for the first of April.

General ABRAHAMSON. One of the advantages for doing it now, if you can take just a minute, is the classification level associated with the schedules. That might be valuable. But I can give you two examples.

Chairman NUNN. Wait a minute. I did not get that. Are you saying there is a sensitivity about the classification of the schedules?

General ABRAHAMSON. Yes, sir. I can handle it in an unclassified way, and I will do my best to do that, but what I have here today are the classified schedules.

Chairman NUNN. Tell us what is sensitive on that, so we will not get them confused, if you would.

General ABRAHAMSON. Delta 181 started as a follow-on to the Delta experiment we had. Initially we said, let us put an [deleted] on that because we wanted more data, and because we had the capability. However, we go through a very complex and frankly exhausting process over in the Departments of Defense and State to get it through and to get decisions to ensure that our tests really do fall within the narrow interpretation of the treaty.

By the way, that is not a black and white process. It is a very complex process. I think Senator Gore, when he went through our Delta 180 experiment, we spent 3 hours on that really going through it carefully. And while he was finally satisfied, there were legitimate questions that he asked and wanted to feel through. So that is a complex process.

By the way, sometimes we do not get through that process for a long time. We started out to include an [deleted] on that, and after we worked on that for 8 months we finally gave up and said, look, it is just not doable to do the kind of [deleted] that we want to do. So we have changed that.

Senator WARNER. Because of the ABM, or technical failure?

General ABRAHAMSON. No, because of the ABM Treaty.

Senator WARNER. When you said you could not do it, I wanted to know why.

General ABRAHAMSON. It just got to be too hard in order to get all the pieces together, and get the data we wanted in the timeframe that we were moving in.

So each——

Senator LEVIN. Excuse me. Could you repeat the answer to that, because I am not sure what you said. Senator Warner said, because ABM, and then you embellished it in your answer, and it sounded like it was something in addition to, or other than the ABM.

General ABRAHAMSON. The fundamental issue is of course we want to do these tests in accordance with a particular schedule.

Senator THURMOND. General, do not drop your voice. Keep it up so we can hear you.

General. ABRAHAMSON. Yes, sir. I am sorry.

We need to do some of these tests in accordance with a particular schedule. As we go through our process, we sometimes find that we get well into the test itself before we finally get enough definition that every question and every detail associated with the treaty, every string has been followed out all the way. So it is an interative process that takes a long time.

On this one, we pursued it for 8 months, and I finally said, no, this does not make sense to pursue this any further. I have got to make a judgment in terms of going ahead. Therefore, I opted for a very conservative kind of test and omitted the [deleted] portion of the test, even though we need the data and it could have been usefully done.

Senator LEVIN. Again, you omitted the [deleted] phase? Why? Because you could not do it in the timeframe? Or because it was not consistent with a narrow interpretation of the treaty?

General ABRAHAMSON. Because after working on the narrow interpretation for 8 months, I could finally see that I had contractors working, that it was not cost effective to proceed. And it became clear to me that I was not going to get there.

Senator LEVIN. And if you had had the broad interpretation before you, then you would have decided to proceed?

General ABRAHAMSON. We would have had more freedom to test. That does not mean that we would not have to go through a procedure and still deal with questions of that kind.

Senator LEVIN. Cost-effectiveness questions?

General ABRAHAMSON. No, not cost-effectiveness questions; ABM Treaty questions. That does not mean that all of the questions are going to go away. They are still going to have to be very carefully and properly looked at.

Senator LEVIN. Just to press that a bit——

General ABRAHAMSON. Many of them would be—there would be a lot more freedom, and I will give you a couple of examples.

Senator LEVIN. Let me just press that a bit. You do not know what the result of your analysis would have been if you were operating under the broad interpretation?

General ABRAHAMSON. No, we did not try.

Senator LEVIN. That is what I mean. So you did not know what the outcome would have been of your analysis whether to proceed. Right?

General ABRAHAMSON. That is correct. However, if it would have been timely—and I will show you that—that we would have restructed this problem, and this is the kind of a possibility, that if we would have had the broad interpretation in a timely way to be able to carry out this program, we would have restructured it to add part of the [deleted] all of those, and obviously that adds a great deal of confidence and additional information to the test.

Now let me just give you a feel for the test itself so you can understand the context of those comments.

This is what it is now. We have a Delta rocket very similar to the one we fired, and in the upper stage the last portion of that rocket, [deleted] that are put in place, and some other sensors and things that are up there, sensors on a ring.

Initially we had an [deleted] in here, and we decided we were going to take that out. We will try to get as much of the information as we can by just [deleted] but we will not get any further confirmation of what this looks like in that last stage, as it gets. Remember, what I said was as always some technical people say that is great, that is exciting, but now we need a little more. That is always the process.

So the way it is structured now is that we have put together [deleted]. Now that is the test now as it is structured.

Before, we were, in addition to that, going to [deleted] because we had a booster, we had the capability, we had the extra weight, and we had sensors in position. So we were going to [deleted] to try to get additional information. Now what does that mean? And it is already out of date.

We were going to be able to [deleted] this whole system about November of this next year. Frankly, I believe that the whole effort is sliding and we will probably be in about [deleted]. But the total savings, because it saves us a whole launch, is a lot of money. I think that is the key now.

As time goes on, this becomes less and less feasible to do that on that date. Obviously we have had already at least some delay. I am not sure I accept all that delay if we did that, but that is the kind of a near-term problem.

If I can give you an example of a long-term problem, because I think that is part of it, last year we did not even think this kind of thing through because the narrow interpretation was what our direction was, and we were just going ahead with the program in that way.

Now what we have been asked to do is to comment and examine what would happen if we had additional tests. The broad interpretation does not mean unlimited freedom, not by any means.

OK, the boost surveillance and tracking system. Remember, this is that satellite that is the long-term kind of surveillance system that provides the information on an attack to the battle management—or to the intercept, and later on would provide that information to lasers and laser mirrors. So it is both a near- and a far-term capability that we must have.

These are the kinds of things that we need to do in order to validate not just one satellite or one test, but this whole stream of technology that is eventually going to be a workable BSTS satellite for us. So we have to validate that we can get the kind of resolution that you can handle the traffic and signal processing. Some of these things you can do on the ground, and some you cannot.

The current approach is, because an early judgment—and by the way, these judgments are if we keep working them and we keep working them and always try to see that we do not invalidate or get up on the edge of the treaty, but at the same time we get as much information as we can. That is a very complex process.

We keep going back and trying to work that through. The current approach is for this satellite to build as much of a focal plane as we can, but maybe not even a full focal plane, because we are going to test the resolution, but we will make an experimental spacecraft that we put up, and that we do not want to try to make this one that could even be accused of having the capability to act as an ABM radar, but it would be a mobile one and it would be in space.

So that the issue is capability to act as an ABM radar. That means having certain characteristics of signal processing, battle management, those kinds of characteristics.

If we had a broad interpretation, one that recognized that this is not a radar, that in fact it is an infrared, an optical system fundamentally different, then we could add the battle management and the signal processing to the satellite. Now what does that mean?

Here is the schedule for that program. Here is the way it is put together now. This is a tough schedule. It is an optimistic schedule. And just last week we announced that we cut down the three contractors down to two. So we now have two contractors working on that system today, and that is the important part, today. When will

it be launched? It is not going to break the treaty, or even have an impact on a treaty issue, until it is tested somewhere around the [deleted] timeframe.

However, I have got contractors working on that concept today. What does that mean? We will put up an experimental satellite that will not have any residual value because it will be an experiment, and it will be very, very expensive. It will be the cost of a big launch, and it will be the cost of a satellite which will not have residual value.

After that satellite is put up, there will have to be some kind of a treaty decision made, either a treaty decision to go to a broad interpretation, or break the treaty and go out.

Senator LEVIN. What is the year?

General ABRAHAMSON. This is [deleted] sir. So that says somewhere out in that timeframe, once you have seen that experiment and get confidence, you cannot logically go forward and do anything more in that fundamental program until you make some kind of a treaty decision.

Now why are you making that treaty decision at that point? Not because you are making the decision to deploy, but because you are making the decision to do another experiment, or to complete the experiment, complete the capability.

So then you would build the satellite, a second one, with all of the data processing and some of the command and control elements on board. Now that one has residual value. [Deleted] but after you get these working, this one is only half working on the ground, then you can do tests with those kinds of intercepts out here somewhere in about 1995. And then once you get a second fully capable satellite up, then you have got the beginnings of an operational system. You do not have enough up there that they have got a full operation, [deleted].

Now if somewhere earlier here, early enough, it does not necessarily have to be tomorrow, but early enough so that you do not waste a lot of money on this partial design, you go forward and you really get aggressive on a full satellite, the one that you launch in that timeframe, and it might go down a little bit, is capable. It has got the data processing on board.

Now notice the time of the experiment is still out here in [deleted] but I have to make that decision as soon as possible in order to tell the contractor to do that kind of work to develop that kind of satellite. What does that mean? I can do some preliminary tests with the space, the SBKKV, something like 2 years earlier.

I can finish up and launch a second satellite, and that has residual capability—and by the way, I do not have to make the treaty decision until I want to go for an operational system. So you are down here.

What does that mean? The savings of a whole launch. The savings may be on the order of a billion dollars and maybe 2 years. So that is the kind of an issue. That is the example of a near-term test and a far-term test. There are not many near-term tests that in the next year that I can change dramatically at this point and conduct the tests that would really have an impact.

Senator LEVIN. My time is up. Thank you.

Senator EXON. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

CURRENT TESTING POLICY

General, does our current testing policy under the ABM Treaty affect any testing for which plans are now being made, or any program for which contracts are now being signed?

General ABRAHAMSON. Could you repeat just the last sentence, please?

Senator THURMOND. I will just repeat the question.

General ABRAHAMSON. I did not hear it.

Senator THURMOND. Does our current testing policy under the ABM Treaty affect any testing for which plans are now being made, or any programs for which contracts are now being finalized?

General ABRAHAMSON. All of our testing, or all of the contracts are being let in the context of the narrow interpretation of the treaty at this point. We are building hardware, as I indicated on this BSTS program, that will not go outside of the narrow interpretation of the ABM Treaty.

DEPLOYMENT DECISION

Senator THURMOND. General Abrahamson, there seemed to be some confusion earlier this year about whether a deployment decision was eminent. Was a deployment decision ever under consideration? And what is your current estimate about when a deployment decision should be made?

General ABRAHAMSON. Sir, I believe that what we were presenting——

Senator THURMOND. Speak a little louder.

General ABRAHAMSON. Yes, sir.

We were presenting so that people could understand the concept of phased deployment. We also put how early that could occur if there were—if you put all the money into the program that is necessary, and if you removed some of the constraints such as the treaty limitations so that you could go forward with the program.

The intent of that was so that you could define for all of our decisionmakers how fast the program could go. I do not believe that in fact we were saying right now make a decision to deploy such a system.

Now I am sure that there were some people that would have been delighted to see that kind of a decision be an outcome, but I think that the importance of what we were presenting was so that people could have for their policy consideration the earliest timeframe, so that if the Congress, and if the Nation felt that they needed it and were ready to go ahead with a major accelerated program, that we could do it in that timeframe.

Now everybody does not agree with all of the dates in that timeframe, but we thought it was important to lay out at least the inner edge of the boundary.

Senator THURMOND. General, in your judgment, how much earlier could a decision to proceed to deployment be made if SDI testing were permitted under the broad interpretation of the ABM Treaty, rather than under the narrow interpretation?

General ABRAHAMSON. I believe, sir, that the question then becomes a matter of the resources, how much money we are allowed to use as we go forward.

In the past I have indicated that I felt that for a reasonable decision that we are talking about the early 1990s, and that meant that you could begin a deployment properly in the mid-1990s.

Now what has happened is we have deferred some of the programs. We have made, I think, extraordinary process in others. If people are willing to make a decision at a higher level of risk, it could be made earlier than that timeframe. But there is still work to be done. That is very clear that that work is to be done. So I do not think that it is easily made within the next year or 2 years, but if it were to be made in that timeframe, if there were a real reason that was very important in terms of either to demonstrate to the Soviets our seriousness either for arms control, or because there was a national emergency that had to be dealt with, the risk going ahead with the program would not be an absolutely unreasonable risk.

We know a lot more than we did a year ago, but it would be a very high-risk effort, and there is no question about that.

BUDGETARY CONSTRAINTS

Senator THURMOND. General, in view of budgetary constraints in fiscal years 1988 and 1989, some have talked in terms of a level of funding for SDI at 1987 levels. What effect would adjustments of this magnitude have on both the timing of a decision to proceed to deployment and the level of confidence you would have in supporting such a decision?

General ABRAHAMSON. It would have a devastating effect, sir. It would in fact delay all of those decisions by more than the year that is apparent. Most importantly what it would do is it would disjoint the elements of the program that we have to bring forward together. It would provide a signal to U.S. industry that they should stop putting their best people and their investment on the program, and it would provide a signal to the Russians that we are not serious about either SDI or its use in arms control. I think it would be a devastating decision, if that happened.

Senator THURMOND. General, from a technical standpoint, what would be the effect of legislation that prohibited expenditures of funds for testing beyond the narrow interpretation of the ABM Treaty for 1 year? Could you continue to conduct the program as now structured if such a prohibition was longer than 1 year?

General ABRAHAMSON. As I mentioned earlier, everything that we are doing now is within the narrow interpretation of the treaty. Therefore, we could continue to conduct the program.

There is a cost and schedule implication associated with that. That does not mean that we must conduct any tests in that timeframe. If there were an extended period where we were directed not to conduct any tests, if we could proceed with building hardware which may eventually allow us to conduct tests either within or external to the treaty, that would at least minimize the impact of such a decision.

Senator THURMOND. Thank you.

I think my time is up, Mr. Chairman.

Senator EXON. Thank you very much, Senator.

EARLY SDI DEPLOYMENT

General, can you tell us if the Joint Chiefs have established a valid military requirement on early SDI deployment in the 1993 to 1994 time period? Can you tell us, perhaps in more specific detail than your general statement, what type of technological progress has occurred since December 18, 1986, to support what appears to be a major shift in administration policy?

General ABRAHAMSON. Let me answer the first part of the question, sir, and I am not sure I understand the last part of the question.

The first part of the question is that the Joint Chiefs, as well as all of the services, recognize the requirement that was implicit in the President's speech. What would have been the equivalent of a phase-zero decision, or a milestone zero decision, was recognized when the program was embarked on at that point.

We are now working with the Joint Chiefs and with the services, and in fact with many other agencies, to conduct what we call a milestone one decision process. One of the outcomes of that milestone one decision process will be a Defense Advisory Board meeting where the requirement will be validated.

It will be aimed primarily at phase one of a deployment, so that we can have a defined task to work against. I would like to be able to get that DAB, which is a very complex process and I have to work with an awful lot of people, done in the April timeframe. I am afraid it will probably slip into the May timeframe. But it certainly is this spring.

Senator EXON. Is that the report that was due April 30? Is that right?

General ABRAHAMSON. No, sir. That would not be a report to the Congress. That would be an internal decision process that we go through inside the Defense Department. It would establish that initial requirement for phase one. Obviously the results of that would be available to the Congress.

Senator EXON. General, it seems to me that the Joint Chiefs of Staff requirement that would set out what the desired system would have to do——

General ABRAHAMSON. Yes, sir.

Senator EXON [continuing]. How effective it would have to be, and so forth, is that not an important part of a requirement?

General ABRAHAMSON. Absolutely. And that is why we are now working with them in order to have that requirement established. As General Herres, who has now of course assumed the new position that the Congress created, has often indicated, that when the military establishment is working on requirements of this kind which are so dramatically different, they must have a strawman or something to start the process with, and then they can go through an iterative procedure and decide that, yes, it needs to be more robust, or it could be less robust to have military significance. So they really needed an input from us for them to be able to exercise

their military judgment against. That is why it has taken us a certain amount of time to get to this point.

Senator EXON. With regard to the detailed plans, I would suspect that there would be some changes made over time. Could you tell us what changes you might envision as a result of these studies that you must have been directly or indirectly involved in, and what changes do you anticipate might be made or might be required as a result of those studies for fiscal years 1988 and 1989? Anything significant?

General ABRAHAMSON. You are asking me to make some judgments on a process which is only just now really underway and beginning to be underway in a fully engaged way between the staffs of the Joint Chiefs and my office and the others.

Senator EXON. Well, that has been underway for some time, has it not?

General ABRAHAMSON. Well, it has been underway, but I think it has been underway primarily with the strong support of the Unified Space Command. While they made very strong and useful inputs into us, the validation process is one that has to be conducted at the level of the Chiefs themselves. And that process, that validation process, is really only the beginning.

So we have had a lot of inputs from them, and——

Senator EXON. And you have had a lot of input into it.

General ABRAHAMSON. Yes, sir.

Senator EXON. Let me phrase the question another way. If this study comes out the way you would like to see it come out, would there be significant changes in the fiscal years 1988 and 1989 budget for SDI?

General ABRAHAMSON. I think there would be some minor changes, but I do not think that it would be a fundamental redirection of the program, sir.

Senator EXON. Or putting it another way, you think that the changes that might come out of that could be funded under the requests that the President has already made in his budget?

General ABRAHAMSON. Yes, sir; I think that it could be absorbed.

Senator EXON. My time is up. I believe Senator Warner is next.

Senator WARNER. I will just be very brief. I will try, frankly, to go over the same ground, but in a very simplified way. If tomorrow morning you received the green light from the executive branch to go abroad, what would be your steps?

General ABRAHAMSON. I would begin to integrate some of these tests. We are looking at how we would restructure the 181 experiment, and that would probably be the first one of major significance. Then we would restructure some of the other tests beyond this.

Senator WARNER. Let's take a fiscal year at a time. On April 1, you got the green light.

General ABRAHAMSON. Let me give you perhaps one of the most important examples that I explained here. I would tell the contractors that are building the BSTS satellites, I would say put in the whole capability right now.

Senator WARNER. Can you quantify that as to what percentage of your overall program would be affected?

General ABRAHAMSON. Well, let me see. The funding for the BSTS——

Senator WARNER. Just a very ballpark figure.

General ABRAHAMSON. It would probably not cause us to have to increase the funding. It would say, change your design effort and get busy and design the satellite the right way, rather than building in one of these side steps, or these partial systems. That is the difference.

Senator WILSON. Let me put it to you in a different way, getting at the same point. You have given us an example on the BSTS of a savings that could be achieved if we went to the broad interpretation to integrate these tests.

General ABRAHAMSON. The savings are primarily out in the out-years, however. They are not in the near years. Maybe I did not make that point.

Senator WILSON. But you are saying it would save 2 years in the example you gave.

General ABRAHAMSON. Yes, sir.

Senator WILSON. And a billion dollars.

General ABRAHAMSON. Now that is a very rough estimate.

Senator WILSON. I think what Senator Warner is seeking to find out—I know what I am seeking to find out—is if you had the authority, the green light tomorrow from Congress and the executive to go ahead and do all the integrating you want to do, what we are looking for is how much time would that save, and how much money would that save, and also are there things which in terms of your development program you could then do under the broad that you could not do under the narrow?

General ABRAHAMSON. I think the answer would be that if these systems really survived as the first phase of a deployment, and I expect that they will, that they will make good sense for a partial deployment, that we could affect, and obviously you are asking me to make a judgment on a study that is not quite complete, that we owe the President by the 30th of April, but that it would mean substantial savings in terms of a year or two across all of those systems.

The total budget implication, obviously it would exceed that one on the SSTS. It would be significantly more than that. I would be just making kind of a guess if I gave you a real number at this point.

Senator WILSON. That is what you are supposed to tell the President?

General ABRAHAMSON. On the 30th of April, sir.

Senator WARNER. Well, we are still struggling. These are the questions I was coming to. As a matter of fact, 2 years ago I think I laid the foundation to ask that famous question, will you save time, will you save money, and you said yes.

General ABRAHAMSON. The answer is yes.

Senator WARNER. But now we seem to be accelerating that decision point where, if we were to make the year April 1987, I think you left us with the impression in that early hearing that I do not have to make that decision; it can be postponed. Somehow in the 2 years that have elapsed, I gain the impression that now that decision has moved forward.

General ABRAHAMSON. Yes.

Senator WARNER. Is that right?

General ABRAHAMSON. I think that what has really happened, sir, is that the way we laid out the program before, it made sense to a technical person. One of the things that has become very, very clear is just how difficult it is to get across this complex program and to gain confidence in what we are doing.

Before, while you asked a very, very important question, we did not go back and study it in depth as we should have or could have at that point in time. Now the President has directed us to do exactly that.

Therefore, what we are trying to produce is a very specific set of answers to that, how much money, when, the specifics exactly as you have asked the question. That is due, as I indicated, on the 30th of April, but I believe all of us truly understand now that that instinctive answer is that we can do it faster and also will result in a vastly improved level of confidence to all of the decisionmakers.

Senator WARNER. Across the board?

General ABRAHAMSON. To the Congress, to an administration at some point in the future when a deployment decision is made.

Senator WARNER. There is a time advantage, and there is a fiscal advantage.

General ABRAHAMSON. Yes, sir.

Senator WARNER. One last point. You opened up by saying one of those particular systems would provide a great deal of help to our [deleted] requirements. It suddenly occured to me that we are struggling with your budget. Maybe we better begin, like they do in the Department of Energy, to pull this budget over into another area to help pay for collateral benefits from other defense and civilian activities. Has anyone looked at that?

General ABRAHAMSON. Yes, sir. That has often come up, and the biggest problem with that—and I can give you a perfect example of it—is the power subsystem that we are looking at for that particular [deleted] is what we call a [deleted] system. It is partially funded by the Department of Energy, and partially funded by our program.

The Department of Energy, even though they do their very best to respond to us and our priorities, they also have other priorities. They have another committee that examines their priorities and puts limits and appropriates money for them. And when we split these projects amongst several responsible agencies and different program element numbers, then we lose the ability to keep it coordinated and keep it coming together.

Senator WARNER. I said I would be brief. I thank the chairman.

Senator EXON. Thank you, Senator Warner.

I guess what we are asking you, General, to paraphrase an old Howard Baker famous statement: How much do you know? And when will you know it?

With that, I will recognize Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

SURVIVABLE AND COST-EFFECTIVE DEFENSE

General Abrahamson, if you were totally unconstrained other than by technological constraints, can the United States deploy a survivable and cost-effective defense against ballistic missiles in the mid-1990s?

General ABRAHAMSON. I think the answer is, yes. It is yes against the kind of responses the Soviets could have then. But we would also be bringing along the kinds of technology behind that to try to deal with the responses that they would have in order to ensure that it remains survivable, or can be upgraded to a survivable system.

Senator WILSON. Can you give us a ballpark figure of the cost to deploy such a survivable system? Would it be around $50 billion?

General ABRAHAMSON. Well, here, sir, it depends on the architecture. Remember, the architecture is driven by the threat, as well. However, the architecture that we have provided as a strawman to the Joint Chiefs of Staff for a phase-one deployment, using today's costing techniques, and assuming that a heavy lift launch vehicle were available not at the very beginning of deployment but were available within a year or two to take part of the deployment economic load off, is on the order of between $40 and $60 billion.

I think the importance of that is, that is a very rough estimate, but it is not out of the ballpark of the estimate of some similar weapons systems that we are talking about. For example, it is in the same ballpark as the small missile.

Senator WILSON. And what, in your judgment, would the emplacement of such a system achieve in terms of denial of the opportunity for a successful decapitating, irrational first strike?

General ABRAHAMSON. Sir, I guess my own feeling is that any war is an irrational act, or at least it starts in an irrational act at some point. The question of how these things really proceed from a crisis to something that is a war is a very difficult one. I think the people who are students of the First World War will see exactly that, that nobody particularly wanted that war. I do not believe that anybody felt that that war happened because one man was assassinated. It happened because it got out of the control of human events for a great number of reasons.

Our hope would be that a phase one would be sized in such a way that it would indeed be able to deny the Soviets the ability to run a clear surprise attack, and to be able to deny them some of their limited options such as a decapitating attack.

Obviously the Joint Chiefs of Staff are struggling with the exact size and shape of an architecture to ensure that that is a meaningful result, and I think that within just a few months they will be able to answer that question in their best military judgment more effectively than I can.

But certainly that is the objective of a phase-one attack, to be able to add to stability in a very significant way by denying them some of the most dangerous ability to structure certain of their attacks, not all of their attacks, and certainly to deny them the option of setting the timing of such an attack.

Senator WILSON. Would you please rank in order as to constraints in terms of the seriousness of the limitations that are

placed on your ability to achieve some first-generation system against ballistic missiles, would you rank in order the constraints imposed by technology, by funding, and by treaty and other political limitations?

General ABRAHAMSON. The first constraint, or the one that is the most constraining, is clearly the funding limit. That is not only for a first-generation system; it is for a long-term system.

Senator WILSON. It is quite serious.

General ABRAHAMSON. Yes, sir.

We are not technology limited.

The second problem is the problem, obviously, of either political constraints or treaty constraints. And the third one, or the last one, is the technology.

Here I think I can only just say again that we have got marvelous, creative people who are taking these technology problems and just chipping away at them, and finding those solutions. But they do need the money in order to keep the teams in place, and the ability to not have to be started and stopped, and started and stopped, as we have to absorb cuts of a third of the program of that nature.

Senator WILSON. General, pursuing a line of questioning that Chairman Exon engaged in with you, are you aware that in an appearance before the subcommittee last week that General Chain from CINCSAC testified that strategic defenses would be extremely helpful to him in achieving his mission to deny the Soviet Union access to his objectives, and that he specifically testified in response to a specific question that far less than a perfect defense would achieve a great measure of intent from his standpoint?

General ABRAHAMSON. I am aware of his testimony, sir. I do not know all of the details of every one of his answers. I think that that is consistent with some of the conflict simulations or wargames that we have run, as well as some of the analysis.

In the beginning there was a major concern that partial defenses would, in fact, be destabilizing. I think that the results of our analysis and some of our wargames, while not an absolute proof because there is no absolute proof in this area, deterrence is a psychological kind of process, but they are showing that partial defenses have great value, particularly in combination with our present systems, and can add to our security, as our present systems are drawn down, again, hopefully through the context of negotiations. I think we are all looking for that.

Senator WILSON. Mr. Chairman, my time has expired, but I would simply add by way of comment an historical footnote to the testimony from General Abrahamson that it was, in fact, the recommendation of the President's Future Security Strategy Study in 1983 that the long-term objectives of achieving this end be accomplished by near-term options, that intermediate steps be employed, and I think this phased deployment that he has discussed today is completely in concert with what was envisioned even at the start of the SDI.

Senator EXON. Thank you, Senator Wilson.

Before we proceed now, the chairman would like to get an idea from the members present about how much time they would like.

The General has been here for 3 hours now. We appreciate his patience, interrupted by our vote.

Senator Wirth has come in. Senator, how much time would you like to have?

Senator WIRTH. I have about four quick questions.

Senator EXON. Four quick questions.

Senator WILSON. Five minutes.

Senator EXON. Five minutes.

Senator THURMOND. Two quick questions. I would say 3 minutes.

Senator EXON. And I will take about 3.

All right, next up is Senator Wirth.

Senator WIRTH. Thank you, Mr. Chairman.

General, as usual you are a very effective and persuasive witness, and we appreciate your being here.

Very quickly, do you have a red team that works on this issue?

RED TEAM

General ABRAHAMSON. Sir, I have more than "a" red team. We have dozens of red teams that are each tackling different parts of the problem. We use a red team in combination with the people who are the advocates of any one system, and in order to try to put some reality into that red team versus blue team structure, we even then have white teams that are the referees in the process.

Senator WIRTH. Is there an equivalent opposite to you as the head of the red team to sort through all of the options that foul you up, if I understand what a red team does, they are supposed to second-guess you in every way possible.

General ABRAHAMSON. Well, he does not have a huge development budget and a huge development program. We do that within the program. Perhaps the most equivalent to me in that process is the chairman of the overall committee that operates and tries to add the dimension that I put on it that says "think Russian."

Senator WIRTH. There is a head of the red team? Is that right?

General ABRAHAMSON. Yes. Well, first of all, I have people in my program who have the countermeasures and red team responsibility, but of course they work for me. They have brought in outside experts, committees of outside experts. For example, we are looking at developing a terminal imaging radar for such a system. Our red team is a group of experts who are radar experts, as well as operational and strategic experts.

Senator WIRTH. Is there one chief of all of the red team activities?

General ABRAHAMSON. Yes. There is an overall committee that——

Senator WIRTH. Is this someone who could come in and tell us from the perspective of the red team what problems you have, and what problems we ought to be looking at?

General ABRAHAMSON. I see now where you are going. There is within my program office the director of our Countermeasures Office who can come in and certainly would be, I think, would begin to meet that requirement. But in addition to that, I would recommend that if you wished that perspective, that you should call on two or three individuals, one from the overall committee

that has the responsibility, as I say, to think Russian and to put all of this in perspective; but in addition to that, I think that you would like to have a member from individual, one or two individual committees that show you the depth and detail in which they go on any one project.

Senator WIRTH. Another question: we have an abiding and growing concern in what is happening in our defense industries and the role the Pentagon and the Defense budget plays overall in the economy.

General ABRAHAMSON. Yes, sir.

Senator WIRTH. And as we look at technological capability and look at the budget, we also have to look at the impacts that SDI will or may have on the economy.

Do you have, or have you done as part of your operation, an analysis answering, for example, a number of questions of: One, what kind of scientific and technological spinoffs are expected of SDI? Second, what kind of an impact might this be having on our civilian research and development needs that are science-based? Third, what role are the Europeans playing technologically, or what the impact of this might be on the defense industry? Do you get the thrust of the question? It is a series of impact questions. Have you had that kind of an analysis done?

General ABRAHAMSON. That is a very complex question, and it is not simply answered. I think we have part of the answer, but not the whole answer, sir.

One of the earliest concerns, and it was a concern of the Congress, was the manpower impact because we have very precious resources in this Nation, and we are going out to impact our need for software engineers, and software programmers, and optical physicists, and people like that. Therefore, we were very pleased to join in a study that was sponsored by the House Investigative Service that I think did a most authoritative study of the impact of that. That is now getting a little old. It is about 2 years old.

Nonetheless, it was an attempt to go out and say, here are the kinds of talent requirements that SDI will have, and specifically to identify those that might be very, very short. Then, to say, and are there many other things going on in the Nation? And of course that is the hard part to quantify, even if we could quantify ours, what other initiatives are going on across the whole broad economic range of the Nation.

But then to try to identify those where we thought there might be a problem. That report is published and is available. What they indicated in general was that, while we clearly will have an impact, we will do two things:

One is that our needs will generate new interest and new people working in some of the most active of our areas of research that the Nation also needs. We are creating a market for the education programs to begin to produce more software programmers, more optical engineers, more people like that.

Senator WIRTH. I suspect there are a number of related questions.

General ABRAHAMSON. Yes, sir. But it did identify certain areas where we know that there will be problems. We can get a copy of that and make that available to the committee and to yourself.

Senator WIRTH. What about the question of spinoffs?

General ABRAHAMSON. Spinoffs is more——

Senator WIRTH. My time has expired, but we will get back to you on that.

Mr. Chairman, thank you for letting me ask a few questions. I appreciate it.

Senator EXON. You need not apologize, Senator Wirth, because you are very patient. I notice when you came in you sat down there in front of all those microphones as if you were about ready to accept or reject a nomination——

Senator WIRTH. We will be following your example, Mr. Chairman.

Senator EXON. We are glad to have you here, and I think I speak for the whole committee on that. And with your training in the House of Representatives, especially as the important subcommittee chairman over there, I know that you, like all House Members, have enjoyed the longevity of talk over here on this side, and you are learning very fast.

Senator WIRTH. The discipline of former House Members is always noticed.

Senator EXON. We notice that.

Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

NO FUNDS FOR SDI INSTITUTE IN 1987

General, Congress did not authorize funds for the SDI Institute in 1987. What effect has this had on your ability to manage the SDI program, and what importance do you attach to the legislation to permit funding for this purpose in fiscal year 1988?

General ABRAHAMSON. Sir, I think that it has had a very significant effect. Frankly, I never understood from the very beginning why that limitation was placed on the program. This is the most complex research program that has ever been undertaken, and it has the broadest reach of any single research program under one objective, any single objective.

We felt that what we needed was a clear capability to do more indepth systems engineering for us, but one that did not have the potential conflicts of interests of certain of the commercial companies or other areas. Therefore, we embarked on a process to be able to acquire that capability.

The process I think has now been validated, in that there is now a GAO report that supports both our need in the process, and we have sent over a report on how we intend to proceed, and how we should deal with some of the concerns stated in Congress.

I would like to offer both of these for the record, because they are both very favorable to our initial need. I would urge that action be taken on this, even prior to the fiscal year 1988 authorization. The need is so severe and so important. And if another vehicle could be found to allow both authorization and to allow freedom in appropriation, I think that it is a responsible way for the Nation to proceed.

Senator THURMOND. I presume from what you have said——

Senator EXON. We will accept those for the record.

[The information referred to follows:]
[GAO report to Congress is retained in committee files.]

REPORT TO THE COMMITTEES ON ARMED SERVICES OF THE SENATE AND HOUSE OF REPRESENTATIVES
RE: FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTER FOR THE SUPPORT OF THE STRATEGIC DEFENSE INITIATIVE PROGRAM

The Secretary of Defense makes this report to the Committees on Armed Services of the Senate and House of Representatives on a Federally Funded Research and Development Center ("FFRDC") for the support of the Strategic Defense Initiative Program ("SDIP"). The FFRDC would be called the Strategic Defense Initiative Institute, or SDII.

Purpose of the FFRDC

The mission of the Strategic Defense Initiative Organization (SDIO) is, objectively, to assess technical questions relating to strategic defense in order to provide national authorities--the President and the Congress--with the necessary information to reach a national decision on strategic defense in the early 1990s. The SDIO's task includes conducting a long-range, directed research program towards what may be an extremely complex and far-reaching system. The requisite research is likely to be correspondingly complex. Programs must be carefully crafted to strike the right balance between pure research, applied experiments, development of research results, and feasibility demonstrations.

The SDIO does no research itself, but is the managing agent for the SDI research program. By itself this is a significant task. A great variety of individual, parallel research efforts must be directed and coordinated to produce integrated results. All of this work must be carefully evaluated. A common data base must be maintained to avoid unnecessary overlap or duplication of effort, and to facilitate cross-information between research projects. In addition, development and definition of the design of a strategic defensive system (the so-called system architecture) necessarily requires ongoing, continuous study and analysis including cost, technology, and performance trade-offs between system elements.

The SDIO requires technical support in these areas in order properly to carry out its management functions for the SDI program. Up to now the necessary support has been provided by the SDIO itself or by outside contractors, but the accelerating rate of research and the evolution of the program require the SDIO to focus on actual program management, and for the necessary technical support to be provided on a long-term, continuous, conflicts-free basis rather than in a piecemeal, ad hoc manner. The need is immediate.

The Senate Armed Services Committee Report on the FY 1987 Defense Budget confirms SDIO's need for this technical support:

> "[T]he Committee does recognize the need for such support in carrying out the system trade-offs and system integration efforts required to manage a program as complex as the Strategic Defense Initiative. Therefore, the Committee strongly endorses the establishment of a means to provide technical support, such as was provided to the Air Force's intercontinental ballistic missile (ICBM) development effort by the Aerospace Corporation."

In connection with my determination that the needed technical support would be best provided by a new FFRDC, the National Defense Authorization Act for Fiscal Year 1987 Section 213(a)(1) requires specific information on the following points:

(1) alternatives to provide the needed technical support;

(2) cost comparison of alternatives;

(3) primary function of the FFRDC;

(4) FFRDC subcontracting;

(5) competitive procurement of the FFRDC;

(6) review of proposals to operate the FFRDC;

(7) specific organizational conflicts of interest;

(8) other conflicts of interest;

(9) selection of FFRDC personnel; and

(10) FFRDC budget set-aside for independent research.

Each of these points is addressed seriatim below, under headings corresponding to language in the legislation. In addition, because of my particular concern that we maximize the use of the private sector and competitive procedures in prosecuting the SDI program, I have taken special care to address the possibility of providing the needed support through consultants or other for-profit entities. As you will see, the need for absolutely objective and conflicts-free advice and exclusive dedication to SDIO, together with the fact that the vast bulk of SDI-related primary research will continue to be performed by outside entities including consultants and for-profit firms, made it clearly impractical and inadvisable to use an existing organization for this specific purpose. This issue was also treated exhaustively in the "Assessment of Alternatives," attached to this report under TAB A, that was performed by the Department of Defense to consider how the SDIO's technical support needs might best be met. Additionally, no private sector company appeared willing to bid on this project on the necessary terms (see Log of Private Sector Enquiries, TAB B), so that the choice of an FFRDC seems clearly validated.

"(1) The ability of existing Federally Funded Research and Development Centers, Federal research laboratories, and private contractors to perform the stated objectives of technological integration and evaluation required by the Strategic Defense Initiative Organization."

Any government agency that wishes to consider setting up a new FFRDC must first carefully consider alternatives that may satisfy the perceived need. See Office of Federal Procurement Policy ("OFPP") Policy Letter 84-1. Accordingly, I directed that such a study be performed. The result, a final report dated March 1, 1986 entitled "Assessment of Alternative Means of Technical Support for the SDIO," found significant advantages in having the needed technical support function provided by an independent FFRDC. A copy of this detailed study is attached to this report under TAB A. In summary, we considered three basic categories of organiza-

tional forms that realistically might meet the technical support needs of the SDIO:

(i) Non-profit firms, including existing Federally Funded Research and Development Centers (FFRDCs), a new division within an existing FFRDC, a new FFRDC, universities, and private, not-for-profit/federal research, laboratories/corporations, new or existing.

(ii) Government organizations, including expansion of the present SDIO staff, a military organization, or a new DoD field agency;

(iii) For-profit firms, including large industrial firms, small-to-mid-size system engineering and technical assistant (SETA) contractors, or a new consortium of such firms or contractors, either U.S. or foreign;

In each case, in order to provide the SDIO with absolutely objective advice, the organization would not be permitted to have any other SDI-related work, nor to serve other clients who themselves have such work.

Our assessment of each category was as follows:

(i) Of the various not-for-profit alternatives examined, a new FFRDC ranked highest. The FFRDC mechanism was considered to offer quick, responsive handling of SDIO needs, while allowing considerable freedom in establishing salary structures and a working environment conducive to attracting top scientific and engineering talent. The establishment of a new FFRDC, specifically oriented to SDIO technical support needs, was found to be likely to result in materially greater responsiveness and support than trying to reorient an existing FFRDC.

While reliance on an existing FFRDC or other non-profit organization potentially would provide more readily or more quickly available capability and staff, none was found to have the breadth of specialized expertise to undertake major SDI technology program review and oversight. Any existing organization, including an existing FFRDC or national laboratory, necessarily will have ongoing work, and a deeper background, in one technology or another. Nor would any organization already in existence be in a position to offer the desired degree of dedication to, and exclusive focus on, the SDI program.

(ii) The use of a government organization to provide the special technical support needs of the SDIO was found to be undesirable for two main reasons: it would be difficult to attract, retain, and manage the required number of highly qualified scientific and engineering personnel; and the needed personnel buildup could not occur sufficiently rapidly, nor respond sufficiently quickly to changing requirements.

(iii) The use of for-profit firms was found to be undesirable because of the conflicts of interest inherent in the for-profit organization approach; the probable inability to ensure total objectivity and independence of thought; and the negative business impact on such a

firm through its necessary dedication to SDIO technical support alone.

This analysis is supported by a recent Congressional Research Service (CRS) report, commissioned by Senators Proxmire and Simon, on the planned FFRDC. The central conclusion of this report stated:

> "Given DoD's stated mission (of technology evaluation and system integration), desired organizational characteristics (of being competent, continuous, and conflict free), and institutional constraints (especially their purported inability to hire enough qualified people in-house), the decision to establish a new FFRDC is consistent."

(Congressional Research Service, "Strategic Defense Initiative Institute: And Assessment of DoD's Current Proposal," May 30, 1986, at p.20)

Use of Existing FFRDCs

An existing FFRDC could provide initial capability quickly, assuming either that there were no heavy backlog of work, or that SDIO priorities were high enough to assure that other commitments of the FFRDC would be deferred. However, no existing FFRDC currently possesses the breadth of SDI-related expertise required. Even if initial capability could be swiftly established, considerable time would be needed to expand to cover all of the necessary work areas. Further, existing FFRDCs have a long history and institutional loyalty, usually to a single sponsor or mission area. To be effective, the SDIO would have to displace the long-term customer of existing FFRDCs, which is unlikely, otherwise the intended benefits will be more apparent than real. Other drawbacks might include schedule, facility, and support constraints caused by personnel ceilings, physical space limitations, and funding caps.

It would be possible to establish a separate division of an existing FFRDC, to be dedicated solely to SDIO. Advantages would be already-established organizational structure, management, and overhead support. Further, much of the set-up work might be done by existing FFRDC personnel rather than use SDIO management resources. Going through an existing organization might also minimize potential opposition to setting up an entirely new FFRDC.

However, in the view of the Department a separate division of an existing FFRDC would still be subject to potentially divided insitutional and customer loyalties, because of overall organizational direction and corporate personality. This is a fundamental disadvantage of using any organization not solely or largely dedicated to SDIO. There are few companies or organizations which are small enough to be free of commitments and vested organizational interest regarding other contracts, including other SDIO contracts, and at the same time large enough to have or maintain the large number of specialists needed in all the required SDI subject areas. The existence of in-place management would also inhibit attracting other senior executives with the necessary experience and background in SDI-related technologies.

The Department believes that the key to meeting fully the technical support needs of the SDIO fully must be total and exclusive dedication to the SDI program. Only a new FFRDC with its stated mission and administrative arrangements tailored

to SDIO technical support and unique requirements can accomplish this.

Use of Federal Research Laboratories

An existing federal research laboratory (national weapons laboratory) would have the prestige to attract national experts, and the knowledge and experience to perform complex technical, policy, and coordination activities. Facilities and support should not be a constraint. The same should be true of an SDIO-dedicated group or semi-autonomous organization set up within an existing lab.

Project responsiveness would be somewhat difficult since none of the National Laboratories are in the Washington, D.C. area, although this problem could be alleviated if a local office were established by one of the labs. Ensuring the objectivity of technical results could be difficult since all the weapons laboratories have vested interests in various portions of the SDI Program. This concern could be eliminated with the establishment of a new natonal laboratory dedicated to SDIO. However, a new lab would possess basically the same advantages as a new FFRDC described above, and no more, while necessarily implying a greater permanence and direction than warranted in this early stage of the SDI program.

Use of Private Sector Firms

In light of our clear preference generally for use of private enterprise, the Department thoroughly considered the use of a for-profit concern to meet the SDIO's long-term needs for these limited, albeit important, technical support functions. Our conclusion, however, was that insoluble conflicts problems would prevent, or would appear to prevent, the kind of objective, "squeaky-clean" approach necessary in providing such support free of any commercial tie. Because we share Congressional concerns that private sector participation in the SDI program be to the maximum extent reasonable consonant with the needs of the program, it is worthwhile to set forth at length that section of the Assessment of Alternatives that addressed this issue:

"b. For-Profit Firms

"As with any other alternative to meet SDIO needs, the for-profit firm must be capable of providing the full range of capabilities in doctrine, technology and system management, and other subject issues. The three basic types of profit-seeking organizations that could serve this function are: (i) small-size, support-service companies; (ii) small-to-intermediate-size companies specializing in studies and analyses; and (iii) large defense contractors. Although each has somewhat different characteristics, as a class their advantages and disadvantages are similar.

"Pro: The fundamental attraction of a private sector firm is its bringing to bear the full strengths of the free enterprise system. Private sector firms generally can be more responsive, timely, productive, and flexible than government entities in providing facilities and support. They are also generally more able to attract key technical talent by offering competitive salary and benefits.

"Con: There are major deficiencies associated with a for-profit contract for the needed support capability.

First, inability to ensure free access to industry proprietary information would be a major failing of this option; free access to information of a proprietary nature is a critical requirement to discharge the technical support function for the SDIO.

"Secondly, use of a for-profit, outside organization appears to raise fundamentally insoluble conflicts problems. For example, contract specifications would have to be very precisely defined to assure that the management goals of the for-profit company were fully compatible with SDIO technical support. Since a private sector firm is likely to have substantial other business, and both short and long-range business strategies beyond the SDI program, it is doubtful that such compatibility could exist, or exist for long.

"Further, to avoid any real or apparent conflicts of interest, a for-profit firm may need to restrict its SDI business to the technical support contract itself. That is because recommendations and analysis to the SDIO from the technical support organization may affect the direction of onward SDIO contracts and literally millions of dollars in production and other service contracts. Moreover, virtually all for-profit organizations (as well as "independent" non-profits, see below) have commercial clients who could benefit from the sensitive or proprietary data that would be gained by the proposed support organization. They also generally reserve the right formally to compete for work whenever and with whomever they want to, which would be incompatible with SDIO needs and requirements.

"Since in order to assure continuity for the SDI program, contractual arrangements necessarily would have to be long-term (either through multiple sole source awards or contract options for three to five successive years after the initial award), the need for the technical support organization to restrict its SDI work to that contract alone would continue for many years. Thus, the firm would be effectively precluded from other SDIO work, including all production and any other service work, as well as, any non-SDIO work with conflicts potential, for an extended period.

"In brief, to meet the SDIO technical support needs, any private sector candidate would almost necessarily have to restrict its business activities to that alone. This is highly likely to be totally unattractive to would-be candidates, let alone a highly qualified and capable firm of the type needed to fulfill the special technical and management needs of the SDIO. Moreover, it is unacceptable to SDIO, DoD, and the U.S. Government generally, to deprive themselves of the benefit of full private sector participation in the bulk of SDI work, including all of any production work and much of the service work; or to deprive any private sector group of the same opportunity. This would be incompatible with our free enterprise system. We are not in the business of removing players from the competitive economy generally or in the onward competition for SDIO and other DoD contracts. It should be noted that the research and other professional services work to be contracted in the course of the SDI program will be substantial, and may well substantially outweigh the technical support contract in question here.

"Finally, there is doubt that an outside, for-profit firm could maintain complete objectivity, even if institutionally dedicated to SDIO. In a competitive environment, there is

inevitable business pressure to keep the government customer happy in order to continue the contractual relationship, which can color the necessary intellectual independence and objectivity. In addition, the particular function of overall system architecture and technical review is one that is central to the SDI program, and therefore most appropriately performed by an organization dedicated solely to SDIO itself.

"Summary: The conflicts of interest inherent in the for-profit organization approach; the probable inability to ensure total objectivity and independence of thought; and the negative business impact through necessary dedication to SDIO technical support alone; all pose serious limitations to using a for-profit organization as a means for extending the SDIO's technical expertise."

In addition to these considerations, no one or even several private organizations appeared to have the breadth of expertise across all involved technologies necessary to meet the needs of overall technical evaluation and integration for the SDI program.

Finally, despite numerous enquiries, no private sector firm appeared willing to bid on or operate the FFRDC on the terms we deem necessary--exclusive dedication to SDIO and no other SDI work--to guarantee the FFRDC objectivity and freedom from actual or apparent conflicts of interest. Executive branch policy (see OFPP Policy Letter 84-1, supra) requires a sponsoring agency to give notice of its intent to establish a new FFRDC by publishing three sets of announcements over the course of 90 days in both the Commerce Business Daily and The Federal Register. In this case, the Department followed this requirement meticulously, with the 90-day period running June 16, 1986. Each announcement, one of which is attached to this report under TAB C as an example, gave full particulars of the SDII's intended mission and identified a contact point within DoD for any desired additional information. In addition, the plans to create the SDII apparently were given extensive coverage in newspapers and trade publications such as Aviation Week, Science Trends Newsletter, Government Computer News, Star Wars Intelligence Report, and International Energy Associates Letter. The head of the SDIO, Lieutenant General Abrahamson, also met personally with representatives of the Professional Services Council, a trade organization of consulting and research groups, to discuss the SDII.

Numerous for-profit concerns did contact the Department in response to these announcements. A complete log of telephone and letter inquiries is attached to this report under TAB B. Each contact was told that, although formal competitive procedures were not being used and that a group had already been invited to submit a proposal, there was no assurance or commitment that such proposal would be accepted. All were told that other proposals were welcome and would be considered fully and fairly. However, no such other proposals have been received, other than one for interim support which will be considered if the need should arise.

It should be stressed that the bulk of primary SDI research will continue to be performed, as now, by other entities, including private consultants and other for-profit firms. We intend strictly to enforce the SDII's focus on its specific functions.

(2) The comparison cost of having the proposed work performed by:
(a) the Strategic Defense Initiative Organization;
(b) federally funded research and development centers in existence on the date of the enactment of this Act;
(c) federal research laboratories;
(d) private contractors; or
(e) such center.

Cost Comparison

A. APPROACH

In order to gain insight in the cost associated with a new FFRDC, it is useful to make a cost comparison of the actual costs associated with existing FFRDCs versus those of a for-profit systems engineering/systems intergration firm versus those of a DoD laboratory, which also represents the costs of an adjunct to the SDIO. In conjunction with this analysis, an estimate of the costs associated with establishing a new FFRDC for SDIO will be discussed.

The yardstick used to make this comparison is the cost per MTS, or "Members of the Technical Staff." The term MTS is a historical designation for select technical professionals who provide the scientific and engineering expertise required in Scientific and Engineering Support contracts, including FFRDCs. Although the term has never been equivalent in meaning between any two contracts, an MTS has been described as a professional scientist or engineer actively and directly engaged in performing the development planning, system engineering, research and experimentation, and technical support. MTS is the basic unit of measurement for stating technical manpower requirements. The mix of education levels, years experience, functional specialities and even number of hours per year counted as one MTS differ widely from place to place.

B. SOURCE

Headquarters Air Force prepared a report entitled "Acquisition Management Review of Scientific and Technical Support Contracts," dated 1 August 1986. The cost data used here on FFRDC and Systems Engineering/Systems Integration contracts and the establishment of a new FFRDC are drawn from this report as is the approach used in developing the cost data for the DoD laboratory.

Cost per MTS includes total contract costs divided by the number of MTS. The composition of costs that comprise MTS total costs include: direct labor, travel, computer costs, consultants, facilities, outside procurement, overhead and fringes, other direct costs, and profit/fee. The Air Force made rough adjustments in the raw cost data to eliminate major anomalies in cost per MTS and normalize the manner in which given MTSs per year were calculated among contractors. Similar adjustments were made to the raw cost data for the DoD laboratory.

C. ALTERNATIVES

The following is a comparison of the adjusted cost per MTS for existing FFRDCs, a for-profit Systems Engineering/ Systems Integration firm (private contractor), and a DoD

laboratory/SDIO adjunct using 1985 data; an explanation for the differences in cost per MTS of these alternatives; and a brief explanation of how each of these costs were developed:

1. Cost per MTS of Alternatives

(a) Existing FFRDC

Range $134,000--$180,000 (1985 dollars)

Average $148,000 (1985 dollars)

(b) Systems Engineering/Systems Integration (SE/SI) Firm (Private Contractor)

Actual- $156,747 (1985 dollars)

(c) DoD Laboratory/SDIO Adjunct

Actual - $145,340 (1985 dollars)

2. Differences in Cost per MTS of Alternatives

There are several explanations for the differences in cost per MTS of these alternatives, particulalry the FFRDCs and the SE/SI (private contractor) firms. SE/SI firms receive higher fees averaging 10 to 11 percent whereas FFRDCs receive on the average 0 to 4 percent. For FFRDCs, the Government does not pay for depreciation on real property, thus the only source of money to these contractors for purchase of such assets is through profit retention or from other sources such as endowment funds. SE/SI firms, however, charge the Government for depreciation on real property. In order to obtain Government business, SE/SI firms additionally charge the Government substantial bid and proposal costs, not incurred or passed on to the Government by FFRDCs.

3. Development of Cost per MTS for Alternatives

(a) FFRDCs

The 1985 figure is take directly out of the Air Force report and represents an average of five FFRDCs reviewed. The range of adjusted costs per MTS for the five FFRDCs reviewed is $134,000 to $180,000. Those FFRDCs at the higher end of the scale include laboratories, organizations with a substantial proportion of PhDs included in the MTS, and organizations with larger support employee to MTS employee ratios.

(b) Systems Engineering/Systems Integration (SE/SI Firm (Private Contractor)

The 1985 figure was developed by averaging the cost per MTS of two SE/SI private contractors included in the Air Force review. The firms were chosen because they are representative of the kind of SE/SI support that the SDIO's FFRDC would provide.

(c) DoD Laboratories/SDIO Adjunct

The 1985 figure represents data gathered on the Naval Surface Weapons Center (NSWC), an industrially-funded activity, which performs technical support for customers in the Navy and other defense activities that need technical

products and services for ship combat systems, ordnance naval mines, and strategic systems. NSWC was chosen as a representative in-house resource with significant MTS talent and a cost accounting system similar to a private firm. The figure also represents what it might cost for an adjunct to SDIO from Government resources to fulfill the mission of an FFRDC. Adjustments were made similar to those made by the Air Force to reflect an MTS composition more nearly approximating that of an FFRDC or Systems Engineering/Systems Integration firm.

D. ESTIMATE FOR NEW FFRDC

In the analysis of costs for existing alternatives, an average cost per MTS of $148,000 was derived for FFRDCs currently in existence, with a range of cost per MTS of $134,000 to $180,000. Since the FFRDC for SDIO should have a large proportion of PhDs included in the MTS and a large support employee to MTS employee ration, it is reasonable to conclude that the cost per MTS would be at the higher end of the scale. $164,000 is midway between the average cost per MTS and the highest cost and represents a reasonable estimate of the cost per MTS for SDIO's FFRDC in 1985 dollars.

The $164,000 figure does not, however, consider start-up costs. Start-up costs are inherent with the establishment of any new organization, be it a new FFRDC, private firm, or a federal research laboratory. These costs are difficult to estimate since they involve a number of variables including the recruitment and hiring of talented people and locating and obtaining faciilities and the necessary equipment to do the job. Normally these start-up costs dissipate over time. Included in the Air Force's review of FFRDCs was a newly established FFRDC whose cost per MTS was projected to stablize after two years. Using this data and projecting for SDIO's FFRDC, the cost per MTS for SDIO's FFRDC would stabilize at $164,000 (in 1985 dollars) in the third year.

E. SUMMARY

In summary, the data above makes the following cost comparison for the various alternatives relative to the establishment of a new FFRDC for SDIO:

Existing FFRDC	SE/SI Firm	In-House Adjunct	New FFRDC
$134,000-$180,000	$156,747	$145,340	$164,000

Although the establishment of a new FFRDC represents one of the highest cost alternatives, the report clearly indicates that the benefits of a new FFRDC dedicated to SDIO far outweigh any differences in cost.

"(3) Whether such center is intended to be--
(a) primarily a study and analysis center; or
(b) primarily a system engineering/system integration center."

The new FFRDC will primarily be a systems engineering/system integration (SE/SI) organization as opposed to one devoted to studies and analyses. However, studies and analyses are an essential part of SE/SI activity, and therefore are not mutually exclusive. When analyses are conducted as a part of the technological or the basis of development planning of the organization, it becomes an appropriate activity for the SDII to perform. The analysis and studies is especially purposeful in the early stages of the SDI program.

"(4) Whether such center will be required or authorized to enter into contracts under which research projects would be performed by other Federally Funded Research and Development Centers, Federal research laboratories, or private contractors."

It is possible that the SDII may subcontract in appropriate circumstances. However, we believe that the SDII will be successful over time in attracting the necessary personnel to avoid any great frequency of subcontracts. If we did not believe so, we would not be setting it up. The proposers of the SDII are also confident in this regard, and they are all individuals with substantial knowledge and expertise in the academic and business worlds.

Further, there should be no SDII-issued research subcontracts at all, since the Institute will not be undertaking primary research on major experiments itself, with the possible exception of updating and refining overall system architecture. The primary role of outside entities in performing basic SDI research should remain undisturbed.

If a particular issue does require a special panel or outside contractor, the SDII should still possess sufficient expertise and perspective on overall system integration and evaluation effectively to monitor and review such work. Even if there were gaps in SDII coverage, these would certainly diminish over time, and it is better that at least some of the SDIO's technical support needs be met through an FFRDC than none.

Again, it should be noted that the SDII's intended functions focus on evaluation and integration of research, not actual performance of research. As now, the bulk of SDI-related primary research will continue to be performed in the private sector and by existing research facilities, including those within the Military Services. It is not the intention that the SDII undertake major experiments itself.

"(5) Whether the contract to operate such center will be awarded on a competitive basis."

I am proceeding on other than a formal competitive basis pursuant to my authority under the Competition in Contracting Act (CICA), "to establish or maintain an essential engineering, research, or development capability to be provided by an educational or other non-profit institution or a federally funded research and development center." 10 U.S.C. 2304(c)(3)(B). I have determined that, in the particular circumstances of this case, the immediate technical support needs of the SDIO would not be met by a full, formal procurement, which in the case of the most recently established DoD-sponsored FFRDC (the Software Engineering Institute) took close to a year. Rapid progress in research, coupled with intensive Soviet efforts in strategic defense, make the provision of needed support to the SDIO time-critical.

Accordingly, I have invited a number of prominent scientific and technical figures to submit a proposal for the operation of the SDII. Many of these persons are also members of the SDI Advisory Committee (SDIAC), a not-for-profit consultative group of private citizens who make available their scientific and technical expertise to the SDI program. It is my determination that the SDIAC members are probably the most qualified people to set up the SDII; they are intimately familiar with

the SDIO's technical support needs and with the scope and direction of the SDI program; they are distinguished science and technology figures of great standing; and they have given unstintingly of their time and energy to public service in the SDIAC, all without pay.

In accordance with Section 213(a) of the National Defense Authorization Act for FY 87, no funds have been obligated or expended for the new FFRDC at this time. It should be noted that no commitment has been or will be made until the indicated proposal has been received, reviewed, and evaluated. As noted, we have in fact been contacted by several companies and individuals in response to the series of announcements of DoD's intent to establish the SDII. Those expressing interest in submitting a proposal have been advised that we will consider fully and fairly any proposals that are received. However, most callers have indicated their disinclination to proceed when advised of the conflicts-of-interest requirements that dictates that the SDII have no other SDI or SDI-related work, nor have other clients who themselves have such work. We have actually received no proposals to operate the SDII, other than the invited proposal.

It appears, therefore, that in any event there exists only one responsible source for this work within the meaning of Section 2304(c)(1) of the CICA. We have received one related proposal to provide interim technical support until the SDII is effectively operational; we have responded that we would consider the proposal should such a need become apparent.

"(6) Whether the contract to operate such a center (a) will be considered by the appropriate Defense Agency; and (b) will be subjected to review by persons to be elected by the National Academy of Sciences."

All proposals to operate the SDII will be considered fully and fairly by the SDIO as the appropriate Defense Agency. There are no present plans to enlist "peer review by persons outside the Government" to be elected by the National Academy of Sciences in this process.

We believe that SDIO has the appropriate resources and personnel to best evaluate proposals to operate the SDII. SDIO personnel are most familiar with the status of the SDI research program and the SDIO's particular needs for technical support. Brigadier General Malcolm O'Neill, SDIO Deputy Director for Systems and Programs, will chair an evaluation board consisting of SDIO Technology Officer Directors. This management team has insights into the needs of the SDI program that are necessary to assess any FFRDC management proposals that may be received. If it is found that additional, outside review is needed, it will be considered at that time.

"(7) Whether such center will be designed to prevent even the possibility of an appearance of a conflict of interest by (a) prohibiting any officer, employee, or member of the governing body of such center from holding any position with:

(i) The Strategic Defense Initiative Organization; or
(ii) A private contract that has a substantial interest in the development of the Strategic Defense Initiative; and

(b) By prohibiting more than one-half of the members of the governing body of the proposed Federally Funded Research Center from simultaneously holding any position with the Strategic Defense Initiative Advisory Committee or any similar body that provides technological, scientific, or strategic advice to the Department of Defense about the Strategic Defense Initiative."

The center will be designed to prevent even the possibility of an appearance of a conflict of interest -

(A) by prohibiting any officer, employee, or member of the governing body of such center from holding any position with -

(i) the Strategic Defense Initiative Organization; or

(ii) with respect to officers and employees, a private contractor that has any interest in the development of the Strategic Defense Initiative, or

(B) by prohibiting more than one-half of the members of the governing body of the proposed Federally Funded Research Center from simultaneously holding any position with the Strategic Defense Initiative Advisory Committee or any similar body which provides technological, scientific or strategic advice to the Department of Defense about the Strategic Defense Initiative, and

(C) by prohibiting members of the governing body of such center from

(i) holding positions of operating managers, principal or chief executives, or officers (not including Directors or Trustees) of companies now doing business with or expecting at any time in the future to seek contracts on the SDI Program, and

(ii) participating in any matter coming before the governing board in which the member has a financial or other interest, which interest could be affected by the governing board's consideration of the matter.

With respect to officers and employees, this design parallels, and to some extent exceeds, the design requested. With respect to members of the governing body the design parallels legislative provisions prohibiting employment with the SDIO and prohibiting more than one-half of the members from simultaneously holding Advisory Committee positions. The design restricts the type of positions members of the governing body may hold with private contractors having an interest in the development of the SDI.

The legislative description includes a prohibition against officers, employees and members of the governing body from holding any position with a private contractor that has a substantial interest in the development of the SDI Program. Thus, the description would allow the center's officers, employees and members of the governing body to hold positions with private

contractors that had some interest in the development of the SDI as long as that interest could not be considered substantial.

The above described "conflicts prohibition" design that the SDIO will include in its sponsoring agreement with the center differentiates between officers and employees on one hand and members of the governing body on the other. Center officers and employees are expected to be involved in evaluations and recommendations leading to decisions that directly and predictably effect entities engaged in or seeking SDI and other Department of Defense business. Holding positions with such entities would present intolerable conflicts of interest for center officers and employees and, thus, they will be prohibited.

Members of the governing body, like members of all profit and non-profit corporate governing bodies, will not be expected to devote full time attention to center operations, will be expected to set center policies at a top, broad-based level not likely to have direct and predictable effect on individual contractors, and will be expected to bring to the governing body broad perspectives gained, in part, by holding positions of high level responsibility in the defense industry. The portion of the conflicts prevention design which includes a prohibition on members of the governing body from holding any position with a private contractor that has a substantial interest in the SDI presents an undue restraint on the center's ability to attract to its governing body individuals having the experience and knowledge necessary to developing realistic, technologically sound, objective policies. Thus we do not believe such an unprecedented restriction is appropriate to members of the center's governing body. We do recognize that traditional fiduciary duties owed to corporate bodies by directors should in themselves prevent real conflicts, we need to include provisions that preclude even the appearance of conflicts. As set forth above in more detail, members of the governing board will be prohibited from holding senior operating positions with private contractors and from participating in center matters that could be perceived as conflicting with their private financial interests.

"(8) Whether other actions will be taken to avoid possible conflict of interest situations within such center."

Regarding post-employment practices, as a non-government organization, an FFRDC is not legally subject to the post-employment restrictions that apply for federal employees. Upon additional investigation and inquiry of counsel, I have been further advised that it would not be appropriate to attempt to impose so-called "revolving door" provisions on FFRDC employees for several additional reasons, including the following:

(a) "Revolving door" restrictions applicable to government employees are enforceable under federal criminal statutes that include provisions for financial penalties and imprisonment. We could not include these sanctions in a contract.

(b) Assuming the FFRDC contractor would agree to "revolving door" provisions in its contract with the government, it would then have to enter into employment contracts with its employees, imposing future employment limitations. These types of limitations have been found to be of questionable enforceability under general principles of contract law, as well as specific state statutes.

(c) Aside from questions about their specific enforceability, provisions limiting future employment are likely to inhibit recruitment of personnel possessing the highest level of relevant expertise.

Concerns in this area appear related to potential involvement of the SDII in review of research proposals. However, SDII functions will be primarily oriented to evaluating research results. When government activities do require the service of a contractor to review proposals submitted by private concerns, it is the general practice to obtain financial disclosure statements from reviewing contractor personnel and their agreement to safeguard proprietary information. We intend to require that this practice be followed as well by the SDII.

"(9) The role of the Department of Defense in (a) the selection of the staff of the center; and (b) the internal organization of such center."

The Director of SDIO will require concurrence of the staff selection for the top level executive (e.g., president) for the SDII and coordination with the appropriate SDIO peer directors in the selection of key SDII technical personnel. It will not exercise veto power over the SDII's staff selection except for that of president. SDIO intends only to seek review and comment authority for other organization officers and senior technical directors of the FFRDC's staff.

Such approval of the handful of key FFRDC personnel is neither new or unusual. For example, the agreement between the Center for Naval Analysis (CNA) and its sponsoring agency, the U.S. Navy, provides that the Center's president and other top officers, including the directors of its various operating divisions, must be subject to approval of Navy representatives. Other FFRDCs also routinely subject their president to the approval of the sponsoring government agency.

We do not believe such a limited role will in any way adversely impact either the objectivity or the independence of the SDII. SDIO, as sponsoring government agency of the SDII, has a duty to take minimal care to ensure fully qualified key personnel for the Institute. In order properly to carry out its technical support mission, it is imperative that SDII personnel possess the highest professional qualifications, and that there be effective communication and liaison between top management of the two organizations. That is the only purpose of such provisions.

There has also been some criticism that the SDII is planned to have a "mirror image" structure to the SDIO, in that it should be divided into technical elements (e.g., directed energy, kinetic vehicles) to correspond to those of SDIO. However, this is only a suggestion. As an independent entity, the SDII can structure itself any way it wants. It simply makes good sense, given the close working relationship and the need for effective liaison between the two organizations, to set up in this way.

"(10) Whether a prescribed minimum percentage of the annual budget of such center will be set aside for research to be conducted independently of the Department of Defense."

We agree that the ability to initiate related research and studies is valuable and should be explored. While we cannot commit in advance to any fixed portion of the SDII

budget being devoted to independent studies, we agree that some flexibility will be built into the Institute, and we will explore contract provisions in negotiation towards that end.

Policy Role

The Senate Armed Services Committee Report, supra, notes, "The Committee does not endorse the establishment of an entity to provide policy, analysis, or to provide studies and analyses separate from that required to perform a technical support function."

I concur. The SDII will be a purely technical support group. The SDIO will retain all management and decision responsibility for the SDI program. The SDII is being established for a very specific purpose, that of providing scientific and technical support to the SDIO in the evaluation and integration of research. It is not intended to perform an oversight or policy function. Those functions, in whole or part, are properly the role of other organizations, including the Congress. As described in OFPP Policy Letter 84-1, supra, the purpose of an FFRDC is to provide support to its sponsoring agency. Neither the SDII, nor for that matter the SDIO itself, will be making national policy decisions on strategic defense. Their mission is to provide objective technical and feasibility data. Policy decisions are the responsibility of the Congress and the President.

Objectivity and Independence of the SDII

The Senate Armed Services Committee Report states the need "for Congress to determine whether such a [federally funded research and development] center...would function as an independent and objective source of information...."

It is precisely the intent that the SDII will function in such a manner. Indeed, that is one of the bases for my decision to meet the SDIO's technical support needs through a new FFRDC. As noted, the advice and recommendations of the SDII may affect the overall direction of research. In order to meet these technical support needs and to provide the SDIO with objective, conflicts-free advice, we judged it best to opt for a new organization exclusively dedicated to these narrow functions. No particular bias or point of view is being sought or is likely. Obviously there must be a commitment to exploring fully and fairly the possibility and technical feasibility of strategic defense. That is the purpose of the SDI program, and given Soviet efforts in this area and any government's first duty to protect its own people, it would be imprudent not to do so. But there is no intent to assure a predetermined view. As noted in the CRS report, supra, "it is not DoD's intention to establish any organization that is unsympathetic to the vision behind SDI; rather it is DoD's intention to establish an organization that is unbiased in its evaluation of which technologies and system concepts are best suited to meet SDI objectives" (p.22, emphasis in original).

The SDII will be independent in the sense of having its own management and providing objective, conflicts-free support, recommendations, and evaluations to the SDIO. It is not intended to be "independent" in the sense of having its own agenda or policy role, nor would such be proper. As noted, an FFRDC does not have a policy or oversight function. Its function is to provide support to, and meet the needs of, the sponsoring agency. In this case, the SDII is being established and

funded to meet the technical support needs of the SDIO in objectively evaluating and integrating SDI research, a purely technical role that the SDIO, if it so chose, properly could perform itself. Naturally there will be close liaison between the two organizations. However, there is no reason to believe that such a working relationship will lead reputable scientists to compromise objectivity or independence.

The requirement that the SDII submit work plans every six months, and that its work proposals be subject to SDIO approval, are both reasonable on their face to ensure that the new center fulfills its stated purpose, meets the SDIO's technical needs, and maintains a proper focus on its specific functions without encroachment on the private sector or other organizations. We are not averse to contract provisions that permit the SDII flexibility to initiate its own proposals, but it is not reasonable to commit a fixed percentage of its budget to such ends, particularly in light of the history of severe cutbacks in requested SDI funding.

Conclusion

The SDIO requires certain technical support if it is successfully to prosecute its mission of managing the SDI program. The establishment of a new federally funded research and development center, free of any commercial tie and dedicated exclusively to these narrow technical functions, is the best alternative to meet that requirement. I appreciate the opportunity to provide this information to the Congress.

ASSESSMENT OF ALTERNATIVE MEANS OF TECHNICAL SUPPORT

FOR THE SDIO: FINAL REPORT

PREPARED BY THE

SDIO TECHNICAL SUPPORT WORKING GROUP

FOREWORD

This assessment was prepared in response to a request from the Director, Strategic Defense Initiative Organization (SDIO), for a recommendation on the best way for the SDIO to obtain the technical and technical management support it now urgently needs to carry out its responsibilities. In November 1985 the SDIO Technical Support Working Group was established consisting of SDIO and SDIAC personnel, to examine and assess all possible institutional forms for providing the SDIO with this support. This working group, with inputs from other elements within DoD and from disinterested outside consultants, identified the criteria for this SDIO support capability. It addressed those criteria and carefully evaluated each of the possible alternatives to meet the long-term needs of the SDIO. It concluded after careful study and consideration that the best option is to establish a new Federally Funded Research and Development Center (FFRDC) dedicated to the SDI program.

This assessment sets forth that evaluation and conclusion. Should that conclusion be adopted, this report is intended to satisfy the requirements of Paragraph 6(b)(1) of the Office of Federal Procurement Policy Letter 84-1 on Federally Funded Research and Development Centers, which requires an evaluation of alternative sources for satisfying the indicated requirement.

1. THE SDIO TASK

The task assigned to the Strategic Defense Initiative Organization (SDIO) is complex in the scope of the science and technology involved, and in the breadth of strategic issues which must be addressed in the search for suitable defensive systems. The interplay of science and technology, strategic issues, and system architectures creates a unique challenge. The technical management of the program must, among other tasks, (1) carry out a program planning task with many critical and interacting elements; (2) perform macro-systems engineering activities against highly fluid requirements; (3) integrate offensive/defense scenarios and analyses into useful conclusions and framing of issues for decision; (4) conduct surveys of new science and technologies to identify promising solutions to key system issues; (5) conduct regular, firsthand audits of laboratory work, experiments and tests to assess technical progress; and (6) design and monitor a complex program control system covering contracts, funding, key milestones, test results, decision points, schedule and other indicators, to allow ongoing examination of alternative courses and apportionment of funding.

The technical challenge facing the SDIO is greater than that posed by any prior national program. It includes conducting a long-range, directed research program towards what may be potentially an extremely complex and far-reaching system. Such a system might appropriately be called a super-system, because its subordinate parts are themselves likely to be complete systems rather than subsystems. The requisite research is likely to be correspondingly complex. Programs must be carefully crafted to strike the right balance between pure research, applied experiments, development of research results, and feasibility demonstrations. Management of a great variety of individual parallel research efforts is by itself a challenge which demands the highest qualifications and experience. Such research must be directed and coordinated so that many different individual efforts produce integrated results. Much of the research, like any follow-on development, will be performed by many different industrial firms, including those outside the United States. It must be directed by managers experienced in the execution of large-scale projects that are geographically and organizationally dispersed.

In addition, development and definition of the design, or system architecture, of such a strategic defensive system will necessarily require ongoing, continuous study and analysis of cost, technology, and performance trade-offs between system elements. The initial architectural work on the SDI program has been performed on a competitive basis by outside contractors. However, as SDI research programs develop, accelerate, and mature, there is and will be a need for continuous, ongoing architectural study and definition from an overall perspective and a background of continuity, in order to permit a national decision in the 1990s on system development. Such perspective and continuity necessarily require long-term, dedicated personnel.

2. STATEMENT OF NEED

Because of the wide scope and complex nature of the SDIO task, it is essential that the SDIO quickly augment its capability for ongoing analysis and direction of its research and technology programs. The additional technical capability needed to do this must (1) include the finest scientific and engineering talent available; (2) be able to grow rapidly to required strength; (3) provide breadth and depth of capability in a wide variety of technology areas and technical disciplines, including threat assessment, doctrinal studies, mission analysis, functional analysis, and both exploratory and applied research; (4) provide total objectivity and precise responsiveness to SDIO requirements; and (5) dedicate itself to SDIO, in order to provide this needed objectivity and responsiveness, and to avoid any conflict of interest. Accordingly, the SDIO Technical Support Working Group has determined that a technical support organization having these general attributes is needed to augment the existing capabilities of the SDIO.

3. CRITERIA TO BE SATISFIED

The criteria for such a technical support organization are based on the above statement of need and the special relationship that must exist between technical support activity and the SDIO. The technical support organization must:

a. Be able to attract and retain top technical and internal management talent. This will require a combination of challenging assignments, important responsibilities, competitive salaries, and a prestigious organization having clearly perceived professional opportunities.

b. Be able to be established quickly and grow rapidly, both in terms of the number of personnel and in functional capabilities as needs unfold.

c. Be flexible in terms of its ability to respond quickly to changes in priorities, budgets, evolving technologies, or other developments. Responsiveness obviously will be enhanced by close proximity and dedication to the SDIO itself.

d. Be able to provide independent and objective advice based on a knowledgeable evaluation of all existing information, including sensitive government and industrial data. It must operate fully in the public interest with full disclosure of its affairs to the government as may be legally required. It must not engage in any production or other service activity related to the SDI program, and must not compete for any other SDIO procurement. It must be free from any apparent or actual conflicts of interest that could influence the objectivity of its output, or appear to give or potentially offer its other clients, if any, an unfair competitive advantage with regard to SDI work through access to inside information.

e. Possess the technical and functional capabilities needed to perform, analyze, integrate, and support the basic and applied research of the SDIO. It must be capable of performing technical program planning and of providing general systems engineering oversight on very large systems.

f. Dedicate itself to this technical support role for the SDIO, and abjure from all other SDI-related work, in order to provide total objectivity and responsiveness to SDIO needs, and

to avoid any actual or apparent conflicts of interest with its defined role.

4. ALTERNATIVES

There are three basic categories of organizational forms that realistically might meet the technical support needs of the SDIO:

a. Government organizations, including expansion of the present SDIO staff; a military service organization, or a new DoD field agency.

b. For-profit firms, including large industrial firms; small-to-midsize System Engineering and Technical Assistance (SETA) contractors; or a new consortium of such firms or contractors, either U.S. or foreign.

c. Non-profit firms, including existing FFRDCs; a new division within an existing FFRDC; a new FFRDC; universities; and private not-for-profit laboratories/corporations, new or existing.

5. EVALUATION OF ALTERNATIVE ORGANIZATIONS

a. Government Organizations

Expansion of SDIO

Pro: Augmenting the SDIO staff (or establishing a new FFRDC, see below) would likely produce the highest degree of objectivity of all the alternatives. Government employees, or those with no other effective institutional loyalties, are the most likely to act in the best interest of the SDIO. SDIO personnel would be most responsive to changing requirements because they would come under the direct supervisory control of the SDIO Staff. They would also enjoy complete and immediate access to necessary data, personnel, and other DoD organizations; this would also be largely true of a separate organization so long as it were in close proximity and dedicated to the SDIO. They would be able to discharge directly the key SDI program task of performing ongoing systems architecture work and overall program technical coordination and review.

Con: The capability of an augmented SDIO Staff to provide the required breadth and depth of expertise would be severely limited by the difficulty of attracting, retaining, and flexibly managing the requisite technical talent. Attracting the sufficient number of highly qualified personnel would be difficult because of the limitations associated with government employment. Although there are many such persons in public service, there is a much larger pool of talent outside the government that probably would be effectively denied to the SDIO under this option. Many scientists, engineers, and other personnel with the required qualifications see their professional growth patterns in the private sector and would be unwilling to become public servants. Government salary and benefit limitations, and the cumbersomeness of Civil Service and other government regulations, would also hinder recruitment. Legal and practical limitations on government provision of facilities and support services could also hinder both initial recruitment and subsequent accomplishment of demanding technical and internal management tasks.

Another difficulty would be the Congressional ceiling on the number of billets for Civil Service employees and military officers. As a result, an increase in SDIO in-house strength could only occur at the expense of other elements of the Department of Defense. This would be resisted, and transfer of billets could not occur rapidly in any event.

In both cases, the administrative and executive efforts to justify the required increase in personnel, negotiate the detailed authorizations, and execute the recruiting action, would, instead of resulting in a reduced management burden, materially increase the demands on key SDIO personnel; and probably result in a very slow process, preventing needed capability from being established quickly.

This alternative is further unattractive because of Civil Service restrictions which substantially limit ability to reassign SDIO personnel or otherwise exercise personnel flexibility.

Other DoD/Government

There are numerous DoD and Military Services facilities in the Washington, D.C. area. Many of the same comments that pertain to the SDIO staff augmentation are also relevant to these alternatives. All alternatives involving DoD organizations, either with existing or augmented personnel, are likely to be ineffective for satisfying the special technical support needs of the SDIO. Existing or new DoD organizations would all have a relative inability, within the constraints of the governmental personnel system, to attract a sufficient number of high quality technical people in an era of highly competitive hiring. All DoD organizations currently involved in the conduct of SDI research and technology, including SDIO itself, are experiencing difficulties in attracting experienced, capable scientists and engineers. This problem exists even at pay grades as high as GS-14/15 and SES. An additional difficulty, realistically, is the potential for inter-Service competition and consequent delay in start-up, including reduced effectiveness where access to other Services is essential. Objectivity on behalf of SDIO might also be more difficult when a related Service program were at issue. Finally, it is not appropriate that a Service or DoD organization other than SDIO, or an organization related to it, undertake what is a key function of the overall SDI program, namely system architecture and ongoing overall technical review.

Summary: The use of a government organization to provide the special technical support needs of the SDIO is undesirable for two main reasons: (1) it would be difficult to attract, retain, and manage the required number of highly qualified scientific and engineering personnel; (2) the needed personnel buildup could not occur sufficiently and could not respond quickly to changing requirements.

b. For-Profit Firms

As with any other alternative to meet SDIO needs, the for-profit firm must be capable of providing the full range of capabilities in doctrine, technology and system management, and other subject issues. The three basic types of profit-seeking organizations that could serve this function are: (i) small-size, support-service companies; (ii) small-to-intermediate-size companies specializing in studies and analyses; and (iii) large

defense contractors. Although each has somewhat different characteristics, as a class their advantages and disadvantages are similar.

Pro: The fundamental attraction of a private sector firm is its bringing to bear the full strengths of the free enterprise system. Private sector firms generally can be more responsive, timely, productive, and flexible than government entities in providing facilities and support. They are also generally more able to attract key technical talent by offering competitive salary and benefits.

Con: There are major deficiencies associated with a for-profit contract for the needed support capability. First, inability to ensure free access to industry proprietary information would be a major failing of this option; free access to information of a proprietary nature is a critical requirement to discharge the technical support function for the SDIO.

Secondly, use of a for-profit, outside organization appears to raise fundamentally insoluble conflicts problems. For example, contract specifications would have to be very precisely defined to assure that the management goals of the for-profit company were fully compatible with SDIO technical support. Since a private sector firm is likely to have substantial other business, and both short and long-range business strategies beyond the SDI program, it is doubtful that such compatibility could exist, or exist for long.

Further, to avoid any real or apparent conflicts of interest, a for-profit firm may need to restrict its SDI business to the technical support contract itself. That is because recommendations and analysis to the SDIO from the technical support organization may affect the direction of onward SDIO contracts and literally millions of dollars in production and other service contracts. Moreover, virtually all for-profit organizations (as well as "independent" non-profits, see below) have commercial clients who could benefit from the sensitive or proprietary data that would be gained by the proposed support organization. They also generally reserve the right formally to compete for work whenever and with whomever they want to, which would be incompatible with SDIO needs and requirements.

Since in order to assure continuity for the SDI program, contractual arrangements necessarily would have to be long-term (either through multiple sole source awards or contract options for three to five successive years after the initial award), the need for the technical support organization to restrict its SDI work to that contract alone would obtain for many years. Thus, the firm would be effectively precluded from other SDIO work, including all production and any other service work as well as any non-SDIO work with conflicts potenial, for an extended period.

In brief, any private sector candidate to meet the SDIO technical support needs will be almost necessarily have to restrict its business activities to that alone. This is highly likely to be totally unattractive to would-be candidates, let alone a highly qualified and capable firm of the type needed to fulfill the special technical and management needs of the SDIO. Moreover, it is unacceptable to SDIO, DoD, and the U.S. Government generally, to deprive themselves of the benefit of full private sector participation in the bulk of SDI work, including all of any production work and much of the service

work; or to deprive any private sector group of the same opportunity. This would be incompatible with our free enterprise system. We are not in the business of removing players from the competitive economy generally or in the onward competition for SDIO and other DoD contracts. It should be noted that the research and other professional services work to be contracted in the course of the SDI program will be substantial, and may well substantially outweigh the technical support contract in question here.

Finally, there is doubt that an outside, for-profit firm could maintain complete objectivity, even if institutionally dedicated to SDIO. In a competitive environment, there is inevitable business pressure to keep the government customer happy in order to continue the contractual relationship, which can color the necessary intellectual independence and objectivity. In addition, the particular function of overall system architecture and technical review is one that is central to the SDI program, and therefore most appropriately performed by an organization dedicated solely to SDIO itself.

Summary: The conflicts of interest inherent in the for-profit organization approach; the probable inability to ensure total objectivity and independence of thought; and the negative business impact through necessary dedication to SDIO technical support alone; all pose serious limitations to using a for-profit organization as a means for extending the SDIO's technical expertise.

c. Non-Profit Firms

Five basic types of non-profit firms could conceivably meet SDIO technical support needs are (i) federally-funded research and development centers; (ii) national laboratories (which technically are also FFRDCs); (iii) non-sponsored or so-called "independent" non-profit organizations such as Battelle or SRI; (iv) university study centers; and (v) other special groups or organizations.

(i) Federally Funded Research and Development Centers (FFRDCs)

Pro: The Department of Defense has extensive experience with such organizations. It has sponsored various different types of FFRDCs, including research and development laboratories formed to undertake particularly demanding research tasks involving technologies still largely confined to universities; studies and analysis centers to provide objective analyses of critical defense problems; and system engineering/system integration centers organized to provide know-how in large system development, integration, and verification. Most have worked well.

An FFRDC has many advantages due to its quasi-governmental status. It is organizationally flexible; it can be implemented as an integral part of an existing organization; as an associated adjunct to an existing organization, or as an entirely new organization. If Washington-based, it can maintain sufficient physical, real-time access to the SDIO for project definition and continuous coordination and liaison. FFRDCs have wide access to government and industry sources of information. As result, this type of support organization has generally been able to produce timely results that are responsive to government needs.

An FFRDC could also offer the SDIO the necessary objectivity and independence of thought if divorced from military service loyalties. While FFRDCs can have other clients, these must be other public agencies; FFRDCs are also forbidden by executive policy (OFPP Letter 84-1), and usually by contract as well, from competing for other work when and where they want. As a result, many of the conflicts problems necessarily present with other alternatives are obviated. Next only to the government itself, the FFRDC as a quasi-governmental yet independent organization is uniquely able to pay an "honest broker" role to fulfill the ongoiong evaluative and other technical support needs of the SDIO.

Finally, the prestige and benefits associated with this type of organization are helpful in attracting quality individuals.

Con: Exclusion of for-profit organizations. However, this negative is clearly outweighed by the fact that undertaking the SDIO technical support role would necessarily preclude a private firm from the much larger body of other SDIO and non-SDIO work (see above).

Existing FFRDCs versus A New One

An existing FFRDC could provide initial capability quickly, assuming either that there were no heavy backlog of work, or that SDIO priorities were high enough to assure that other commitments of the FFRDC would be deferred. However, no existing FFRDC currently possesses the breadth of SDI-related expertise required. Even if initial capability could be swiftly established, considerable time would be needed to expand to cover all of the necessary work areas. Further, existing FFRDCs have a long history and institutional loyalty, usually to a single sponsor or mission area. To be effective, the SDIO would have to displace the long-term customer of existing FFRDCs, which is unlikely, otherwise the intended benefits will be more apparent than real. Other drawbacks might include schedule, facility, and support constraints caused by personnel ceilings, physical space limitations, and funding caps.

It would be possible to establish a separate division of an existing FFRDC, to be dedicated solely to SDI. Advantages would be already-established organizational structure, management, and overhead support. Further, much of the set-up work might be done by existing FFRDC personnel rather than use SDIO management resources. Going through an existing organization might also minimize potential opposition to setting up an entirely new FFRDC.

However, in the view of the Working Group a separate division of an existing FFRDC would still be subject to potentially divided insitutional and customer loyalties, because of overall organizational direction and corporate personality. This is a fundamental disadvantage of using any organization not solely or largely dedicated to SDIO. There are few companies or organizations which are small enough to be free of commitments and vested organizational interest regarding other contracts, including other SDIO contracts, and at the same time large enough to have or maintain the large number of specialists needed in all the required SDI subject areas. The existence of in-place management would also inhibit attracting other senior executives with the necessary experience and background in SDI-related technologies.

The Working Group believes that the key to meeting fully the technical support needs of the SDIO fully must be total and exclusive dedication to the SDI program. Only a new FFRDC with its stated mission and administrative arrangements tailored to SDIO technical support and unique requirements can accomplish this.

(ii) National Laboratories

Pro: An existing national weapons laboratory would have the prestige to attract national experts, and the knowledge and experience to perform complex technical, policy, and coordination activities. Facilities and support should not be a constraint. The same should be true of an SDIO-dedicated group or semi-autonomous organization set up within an existing lab.

Con: Project responsiveness would be somewhat difficult since none of the National Laboratories is in the Washington, D.C. area, although this problem could be alleviated if a local office were established by one of the labs. Ensuring the objectivity of technical results could be difficult since all the weapons laboratories have vested interests in various portions of the SDI Program. This concern could be eliminated with the establishment of a new natonal laboratory dedicated to SDIO. However, a new lab would possess basically the same advantages as a new FFRDC described above, and no mcre, while necessarily implying a greater permanence and direction than warranted in this early stage of the SDI program.

Summary: An FFRDC has the same advantages and greater flexiblity.

(iii) "Private" or "Independent" Not-for-Profit

Examples of private not-for-profit laboratories or corporations include SRI, Battelle, SWRI, and MRI.

Pro: Many although not all of the same advantages as an FFRDC and University Study Center, including organizational flexibility; high prestige; ability to attract high-quality personnel; adequate facilities and support and, in the case of an existing organization, in-place administrative and overhead structures; and independence.

Con: The same, substantial disadvantages associated with for-profit, private sector firms (see above).

Summary: Basically the same conclusions as for for-profit, private sector firms; offers somewhat fewer advantages and substantially greater disadvantages than an FFRDC.

(iv) University Study Centers

Pro: A university study center could be very successful in attracting key experts, would be qualified to conduct studies, host workshops and organize working groups, and could be counted on to produce high-quality work.

Con: Finding an appropriate university sponsor might be difficult. There are only a few universities in the Washington, D.C. area, and none with a great deal of strategic space defense related work. Second, there would be a certain lack of flexibility, since such an organization might find some projects inconsistent with the objectives of its university association. Third, access to security information and proprietary data may

well be difficult. Fourth, universities generally are not equipped to deal with large-scale technical management support; this factor alone would make it difficult for a university study center to perform ongoing, overall systems architecture and integration work. Fifth, the independent nature of such organizations would make SDIO liaison and timely project completion more difficult. Sixth, providing secure facilities could prove to be a significant problem.

Summary: For all these reasons, the Working Group sees this alternative as clearly undesirable.

(v) Other Special Groups or Organization

One such group could be a National Academy of Sciences (NAS) standing committee.

Pro: As with some of the other possibilities, prestige of an NAS would attract key people from throughout the country; a standing committee generally offers high quality and objectivity. Studies, workshops, and working groups of varying sorts can easily be set up within the committee.

Con: Control of NAS efforts is generally loose, which would hinder the desired responsiveness to specific SDIO needs and direction. This could be particularly troublesome when dealing with sensitive issues. Access problems may also exist because of security considerations. Finally, an NAS would have difficulty providing for continuing functions like database maintenance, and providing secure facilities and support for a variety of activities. Again, this would cripple overall architectural and integration progress.

Summary: Negatives outweigh positives.

Of all the non-profit options examined, the FFRDC option ranked highest in the evaluation of alternative support organizations for the SDIO. The FFRDC mechanism would provide quick, responsive handling of SDIO needs, while allowing considerable freedom in establishing salary structures and working environments conducive to attracting top scientific and engineering talent. While reliance on an existing FFRDC or other non-profit organization would potentially provide a more readily or quickly available capability and professional staff, no existing FFRDC or non-profit organization has the breadth and depth of talent to undertake major SDI technology program review and oversight. It is, therefore, unlikely that such a ready core of specialized expertise would be available within existing organizations. Nor is any existing FFRDC, given background and ongoing work, in a position to offer the desired degree of dedication to and exclusive focus on the SDI program. The establishment of a new FFRDC, specifically oriented to the SDIO needs, would likely provide materially greater responsiveness to the particular issues associated with the SDI program than trying to reorient an existing FFRDC.

6. CONCLUSIONS

The results of this study establish the following rank ordering of alternatives:

a. A new FFRDC.

b. A new division within an existing FFRDC.

c. An existing FFRDC.

d. Contract with a university or other non-profit institution other than an FFRDC.

e. For-profit contract organization.

f. Augment SDIO or other existing DoD agency with additional personnel.

g. A new DoD organization.

7. RECOMMENDATION

It is the opinion of the SDIO Technical Support Working Group that a "Strategic Defense Initiative Institute" (SDII) should be established as a new Federally Funded Research and Development Center, as a technical support activity to the SDIO. A new FFRDC could be established and fashioned precisely to meet the SDIO management and technology challenge. The new organization should be designed in such a way as to be complementary to the SDIO. Decision-making responsibility for the SDI program must rest with SDIO, while the technical analyses and studies, program integration, and identification of promising solutions to key system issues can be performed by the SDII. The proposed Mission Statement for such an organization is attached as Appendix A.

MISSION STATEMENT

The specific mission of the SDI technical support organization will be to perform, in a highly flexible manner, research, studies, and analyses of emerging technologies and system concepts relative to the Strategic Defense Initiative Program (SDIP); and to provide technical evaluation of basic and applied research efforts and program developments by other contractors. In particular, the scope and nature of the effort to be performed by the SDI technical support organization in support of the SDIO will include, but not be limited to: (1) Identifying and evaluating existing and potential technical advances, technologies, and system concepts from all available sources; (2) Reducing the costs and increasing the effectiveness of basic and applied SDIP research; (3) Providing advice on the relative utility and integration implications of each of the complex technical aspects of the SDIP; (4) Assessing and helping to develop evolving technical requirements, architectures, and their related testbed needs; (5) Performing test and evaluation planning; (6) Integrating offense/defense scenarios and analyses into useful conclusions and framing of issues for decision by the SDIO; (7) Developing and maintaining a data base on active SDIP projects and capabilities, and continually analyzing same for overlap, duplication, and opportunities for coordination; (8) Conducting SDIP-related studies and analyses; and (9) Coordinating and performing other technical and liaison tasks, including interface with the pertinent acquisition activities of the military services, related to performance of SDIP-related technical activities in industry, universities, government laboratories, and elsewhere.

Appendix A

LOG OF TELEPHONE CALLS/LETTERS
IN RESPONSE TO SDII ANNOUNCEMENTS

This list does not include calls to or from Congressmen and staffers, or those internal to DoD, as records were not kept of such calls.

Contacts from individuals seeking personal employment with the SDII are not identified by name for reasons of confidentiality.

DATE	FORM	CALLER	LOCATION	RETURNED
17 Mar	call	Riverside Research Institute	New York, NY	19 Mar
17 Mar	call	personal employment	Florida	17 Mar
18 Mar	letter	Computer Systems and Software Design	Menasha, WI	24 Mar
18 Mar	call	Riverside Research Institute	New York, NY	19 Mar
18 Mar	call	State of Illinois	Springfield, IL	19 Mar
18 Mar	call	Sverdrup Corp.	Tullahoma, TN	19 Mar
18 Mar	call	System Development Corp.	San Diego, CA	19 Mar
19 Mar	call	ANSER Corp.	Crystal City, VA	19 Mar
19 Mar	call	Cassidy & Associates	Washington, DC	19 Mar
19 Mar	call	IIT Research Institute	Washington, DC	19 Mar
19 Mar	call	Riverside Research Institute	New York, NY	19 Mar
19 Mar	call	personal employment	Armonk, NY	19 Mar
19 Mar	call	Sonex Enterprises	Vienna, VA	19 Mar
19 Mar	call	personal employment	Los Angeles, CA	19 Mar
20 Mar	call	Association for Affiliated College and University Offices	Washington, DC	20 Mar
20 Mar	call	Battelle Research Institute	Washington, DC	20 Mar
20 Mar	call	ERIM Co.	Ann Arbor, MI	20 Mar
20 Mar	letter	Sentinel American Research Center	Copiague, NY	24 Mar
20 Mar	call	Office of Federal Procurement Policy	Washington, DC	20 Mar
21 Mar	call	Acurex Co.	Dayton, OH	24 Mar
21 Mar	call	Arthur D. Little	Washington, DC	21 Mar
21 Mar	letter	C.B. Tang, Inc.	Lexington, MA	25 Mar
21 Mar	call	Systems Planning & Analysis	Falls Church, VA	24 Mar
24 Mar	call	B-TAC	unknown	24 Mar
24 Mar	call	Brimrose Corp.	Parkville, Md	24 Mar
24 Mar	call	Orbital Systems	Hyattsville, MD	24 Mar
24 Mar	letter	PSC, Inc.	Fairfax, VA	31 Mar
24 Mar	call	Research Triangle Institute	Durham, NC	24 Mar
24 Mar	call	Sverdup Corp.	Tullahoma, TN	24 Mar
24 Mar	call	Congressional Research Service	Washington, DC	24 Mar
25 Mar	call	Dr. Magon (firm unknown)	unknown	25 Mar
25 Mar	call	personal employment	Wisconsin	25 Mar
26 Mar	call	Dow Chemical	Midland, MI	26 Mar
26 Mar	call	personal employment	Washington, DC	26 Mar
26 Mar	letter	Florida State University	Tallahassee, FL	1 Apr
26 Mar	call	C.B. Tang, Inc.	Lexington, MA	26 Mar
27 Mar	letter	Applied Science Associates, Inc.	Palos Verdes, CA	31 Mar
28 Mar	letter	Applied Concepts	La Jolla, CA	4 Apr
31 Mar	letter	Arizona State University	Tempe, AZ	9 Apr
31 Mar	call	I.E.A.	Oakridge, TN	31 Mar
31 Mar	call	Arthur D. Little	Washington, DC	31 Mar
31 Mar	letter	Univ. of Oklahoma	Norman, OK	7 Apr
1 Apr	letter	Univ. of Cincinnati	Cincinnati, OH	8 Apr
1 Apr	letter	Riverside Research Institute	New York, NY	15,21 Apr
2 Apr	letter	Edison Welding Institute	Columbus, OH	8 Apr
2 Apr	letter	Fusion Power Associates	Gaithersburg, MD	8 Apr
3 Apr	call	EBASCO Services	New York, NY	3 Apr
3 Apr	call	ERCI	Washington, DC	3 Apr
3 Apr	call	I.T.I.	Cincinnati, OH	3 Apr

DATE	FORM	CALLER	LOCATION	RETURNED
3 Apr	letter	Japan Trade Center	New York, NY	8 Apr
4 Apr	call	ERIM Co.	Ann Arbor, MI	4 Apr
7 Apr	call	Gale Research Co.	Detroit, MI	7 Apr
7 Apr	letter	purported FOIA request	College Station, TX	on receipt
8 Apr	call	Government Computer News	unknown	8 Apr
8 Apr	call	CRS	Washington, DC	8 Apr
8 Apr	call	personal employment	Los Angeles, CA	on receipt
9 Apr	call	GAO	Washington, DC	8 Apr
9 Apr	call	personal employment	Connecticut	9 Apr
10 Apr	letter	personal employment	Richfield, MN	10 Apr
11 Apr	call	DuPont Co.	Wilmington, DE	14 Apr
14 Apr	call	Intercon Systems Corp.	Rockville, MD	14 Apr
14 Apr	call	SofTech, Inc.	Alexandria, VA	14 Apr
15 Apr	letter	Synernet Corp.	Fremont, CA	23 Apr
17 Apr	letter	Applied Science Assoc., Inc.	Palos Verdes, CA	n/a
18 Apr	letter	Dr. David Swanson	Palos Verdes, CA	23 Apr
18 Apr	call	Delegation of European Communities	Washington, DC	18 Apr
18 Apr	call	ERIM Co.	Ann Arbor, MI	18 Apr
18 Apr	call	Hudson Research Inst.	unknown	18 Apr
21 Apr	call	Brighton Machine	Pittsburgh, PA	21 Apr
21 Apr	call	Univ. of Alabama	Tuscaloosa, AL	21 Apr
22 Apr	call	Decisions and Designs Inc.	McLean, VA	22 Apr
22 Apr	call	EBV Software Engineering	Frederick, MD	22 Apr
22 Apr	call	GTE	Mountain View, CA	22 Apr
22 Apr	call	Aviation Week	Neptune, NJ	22 Apr
22 Apr	letter	Communications by Design	Sacramento, CA	29 Apr
23 Apr	call	Combustion Engineering	Connecticut	23 Apr
23 Apr	letter	Logan Engineering	Jacksonville, FL	23 Apr
23 Apr	call	Science Trends Newsletter	unknown	23 Apr
23 Apr	call	Sage Federal Systems	unknown	23 Apr
23 Apr	letter	Teledyne/Hastings-Raydist	Hampton, VA	28 Apr
23 Apr	call	personal employment	Monument, Co	23 Apr
23 Apr	call	personal employment	Blacksburg, VA	23 Apr
23 Apr	call	personal employment	unknown	23 Apr
24 Apr	letter	Technology For Energy Corp.	Knoxville, TN	28 Apr
24 Apr	call	personal employment	unknown	24 Apr
24 Apr	call	IIT Research Institute	Washington, DC	24 Apr
24 Apr	letter	Kominek & Associates	Wilmette, IL	29 Apr
24 Apr	letter	Physical Sciences Inc.	Andover, MA	30 Apr
24 Apr	call	Quadelta	Fairfax, VA	24 Apr
24 Apr	card	LOGIKS	San Fafael, CA	29 Apr
25 Apr	letter	Decisions and Designs, Inc.	McLean, VA	n/a
25 Apr	letter	Exotech, Inc.	Campbell, CA	9 May
25 Apr	call	Northeastern University	Boston, MA	25 Apr
25 Apr	call	Technology Marketing	Bowie, MD	25 Apr
26 Apr	letter	Big Sky Laser Corp.	Bozeman, MT	2 May
28 Apr	call	Ametek Inc.	Anaheim, CA	28 Apr
28 Apr	letter	The Endmark Corp.	Arlington, VA	1 May
28 Apr	letter	Martingale Research Corp.	Plano, TX	1 May
28 Apr	call	Precision Manufacturing	Fargo, ND	28 Apr
28 Apr	call	Riverside Research Institute	New York, NY	28 Apr
30 Apr	call	Cushing Associates	Annapolis, MD	1 May
30 Apr	letter	Jaycor	Vienna, VA	5 May
30 Apr	call	personal employment	Rancho Bernardo, CA	30 Apr
1 May	letter	Univ. of Arizona	Tucson, AZ	7 May
1 May	call	Cushing Associates	Annapolis, MD	1 May
1 May	call	EG&G, Inc.	Washington, DC	1 May
1 May	letter	E/M Lubricants, Inc.	West LaFayette, IN	5 May
1 May	call	SofTech., Inc.	Alexandria, VA	1 May
1 May	call	Common Cause	Washington, DC	1 May
2 May	call	Cray Research	unknown	2 May
2 May	call	Common Cause	Washington, DC	2 May
2 May	call	CalSpan/Franklin Research Center	Arlington, VA	2 May
2 May	call	Houston Area Research Center	Houston, TX	2 May
5 May	letter	Interface Technology, Inc.	Laurel, MD	8 May

DATE	FORM	CALLER	LOCATION	RETURNED
5 May	letter	Lentec Corp.	Albuquerque, NM	9 May
5 May	call	Univ. of Texas at El Paso	El Paso, TX	5 May
5 May	call	personal employment	Cleveland, OH	5 May
5 May	call	personal employment	Washington, DC	5 May
6 May	call	CACI, Inc.	Arlington, VA	6 May
6 May	call	personal employment	Boston, MA	6 May
6 May	call	Houston Development Council	Houston, TX	6 May
6 May	letter	Oregon State University	Corvallis, OR	15 May
7 May	call	Henrico County	Henrico County, VA	7 May
7 May	call	personal employment	unknown	7 May
7 May	call	CRS	Washington, DC	7 May
8 May	letter	Gould Electronics	Middletown, RI	9-11 May
13 May	call	ERC	unknown	13 May
16 May	call	DCS	Arlington, VA	16 May
19 May	call	Univ. of Arizona	Tucson, AZ	19 May
22 May	letter	Swannack & Associates	Federal Way, WA	11 Jun
24 May	call	Peat Marwick	Washington, DC	24 May
24 May	call	F. Israel law firm	Washington, DC	24 May
27 May	call	Dynamics Research Corp.	Wilmington, MA	27 May
27 May	call	Leslie Mangere (firm unknown)	Rockville, MD	27 May
27 May	call	EEE	unknown	27 May
28 May	letter	Arizona State University	Tempe, AZ	9 Jun
29 May	letter	AMAF Industries, Inc.	Columbia, MD	19 Jun
30 May	letter	System Development Corp.	Fredericksburg, VA	9 Jun
3 Jun	letter	Mississippi State University	Mississippi State, MS	9 Jun
4 Jun	letter	Arist Corp.	Alexandria, VA	9 Jun
5 Jun	call	Westinghouse	Pittsburgh, PA	5 Jun
5 Jun	letter	personal employment	Alexandria, VA	n/a
6 Jun	letter	Colorado State Univ.	Fort Collins, CO	11 Jun
7 Jun	letter	personal employment	Madison, WI	n/a
11 Jun	call	Univ. of Lowell	Lowell, MA	11 Jun
18 Jun	letter	Beazley & Associates	Houston, TX	23 Jun
19 Jun	letter	Ver-Val Enterprises, Inc.	Ft. Walton Beach, FL	23 Jun
20 Jun	letter	Univ. of Arkansas	Little Rock, AR	7,8 Jul
23 Jun	call	EVB Engineering	Frederick, MD	23 Jun
24 Jun	call	Quadelta	Fairfax, VA	24 Jun
25 Jun	call	General Electric	Denver, CO	25 Jun, 1 Jul
25 Jun	letter	personal employment	Washington, DC	2 Jul
26 Jun	call	Westinghouse	Pittsburgh, PA	26 Jun
1 Jul	call	National Science Foundation	Washington, DC	1 Jul
7 Jul	letter	Economic Development Council of Northeastern Pennsylvania	Pittston, PA	11 Jul
8 Jul	call	personal employment	Washington, DC	8 Jul
10 Jul	call	personal employment	Washington, DC	10 Jul
14 Jul	call	City College of New York	New York, NY	11 Jul
17 Jul	call	Solar Kinetics	Dallas, TX	17 Jul

Dates Unknown:

call	ACTA consulting engineers	unknown	same day
call	Bebecon, Inc.	Salt Lake City, UT	same day
call	Physical Dynamics of San Diego	San Diego, CA	same day
call	Pagonas & Donnelly consulting	unknown	same day
call	SofTech, Inc.	Alexandria, VA	same day
call	Titan Systems	Colorado Springs, CO	same day
call	Univ. of Calif. at Irvine	Irvine, CA	same day
call	personal employment	Denver, CO	same day
call	personal employment	New Mexico	same day
call	personal employment	Unknown	same day
call	personal employment	Unknown	same day
call	personal employment	El Segundo, CA	same day

Dates Unknown:

call	personal employment	Titusville, FL	same day
call	personal employment	Dallas, TX	same day
call	Wallach Associates	Washington, DC	same day
call	GAO	Washington, DC	same day
call	Wharton Business School student	Philadelphia, PA	same day
call	Star Wars Intelligence Report	San Diego, CA	same day
call	International Energy Associates Letter	unknown	same day
call	Government Computer News	unknown	same day

Strategic Defense Initiative Organization

ACTION: Notice of DoD Intent To Establish a Federally Funded Research and Development Center (FFRDC).

SUMMARY: The Department of Defense announces its intention to establish a Federally Funded Research and Development Center (FFRDC) to support the Strategic Defense Initiative Organization (SDIO) and to designate the FFRDC as the Strategic Defense Initiative Institute (SDII). The purpose of this action is to make continuously available to the Strategic Defense Initiative Organization (SDIO) a relatively small but dedicated technical support unit that can facilitate the utilization, in a manner that is more timely, cost effective, and productive than currently possible, of the large national capability that must be applied to the Strategic Defense Initiative Program (SDIP). To accomplish this goal, the support unit personnel must have the across-the-board SDI-related technical skills and functional capabilities to perform a technology evaluation and integration role in support of the SDIO.

The SDII will seek flexible and innovative approaches to solving complex and multidimensional problems for the SDIP. In accomplishing this task, it will tap the broad base of talent, relevant experience, and perspectives available from addressing prior programmatic challenges. This will require contributions from a wide range of agencies and existing organizations, each of which already has some of the resources and skills in the needed areas, but no one of which can address SDIP technical support needs as a unified, coordinated whole.

The SDII must be free from actual, potential, or apparent individual or organizational conflicts of interest. It must gain no competitive advantage from its position over those whose efforts it is helping the SDIO oversee; nor lack objectivity as a result of having profit-seeking, manufacturing, or other conflicting organizational goals, such as a desire to serve other clients.

It has been decided, based on a careful comparative evaluation by the SDIO of all feasible institutional alternatives, that only a carefully designated, new Federally-Funded Research and Development Center (FFRDC) within ready physical access of the SDIO can effectively satisfy the above purpose for the SDII. Accordingly, this announcement is being issued in compliance with the procedures of OFPP Policy Letter 84-1 of April 4, 1984, "Federally Funded Research and Development Centers."

The Mission Statement for the SDII is as follows:

Mission Statement

The specific mission of the SDII will be to perform, in a highly flexible manner, research, studies, and analyses of emerging technologies and system concepts relative to the Strategic Defense Initiative Program (SDIP); and to provide technical evaluation of basic and applied research efforts and program developments by other contractors. In particular, the scope and nature of the effort to be performed by the SDII in support of the SDIO will include, but not be limited to: (1) Identifying and evaluating existing and potential technical advances, technologies, and system concepts from all available sources; (2) Reducing the costs and increasing the effectiveness of basic and applied SDIP research; (3) Providing advice on the relative utility and integration implications of each of the complex technical aspects of the SDIP; (4) Assessing and helping to develop evolving technical requirements, architectures, and their related testbed needs; (5) Performing test and evaluation planning; (6) Integrating Offense/Defense scenarios and analyses into useful conclusions and framing of issues for decision by the SDIO; (7) Developing and maintaining a data base on active SDIP projects and capabilities, and continually analyzing same for overlap, duplication, and opportunities for coordination; (8) Conducting SDIP-related studies and analyses; and (9) Coordinating and performing other technical and liaison tasks, including interface with the pertinent acquisition activities of the military services, related to performance of SDIP-related technical activities in industry, universities, government laboratories, and elsewhere.

This announcement is not a synopsis in accordance with Section 18 of the Office of Federal Procurement Policy Act, or otherwise a synopsis of sources sought in connection with a procurement. It is being published in response to paragraph 6b(2) of the Office of Federal Procurement Policy letter on FFRDC's which provides for at least three notices over a 90-day period in the *Commerce Business Daily* and the Federal Register indicating an agency's intentions to sponsor an FFRDC and the scope and nature of the effort to be performed by the FFRDC.

FOR FURTHER INFORMATION CONTACT: Mr. Richard Sybert, Special Assistant to the Secretary, Executive Secretariat/OSD, Pentagon 3E880, Washington, DC 20301-1000, telephone (202) 697-6388.

Patricia H. Means,

OSD Federal Register Liaison Officer, Department of Defense.

April 18, 1986.

[FR Doc. 86-8858 Filed 4-18-86; 8:45 am]

BILLING CODE 3810-01-M

Senator THURMOND. So you are very interested in having funds provided for the SDI Institute, and feel it would be necessary?

General ABRAHAMSON. Yes, sir, I think we need it, and I think we need it before this authorization bill is completed.

Senator THURMOND. The other question I had was, have any options been considered and rejected that would provide strategic defense capabilities earlier than the space-based kinetic kill vehicles and the Eris program? And if there were such options, what was the basis for their rejection?

General ABRAHAMSON. The single option that I believe was looked at and rejected was a very limited deployment within the 100 interceptors that are allowed by the ABM Treaty. The basis for that rejection was not that there was not merit in that effort. It is that the military capability that that would offer was insufficient for the amount of procurement investment that would be required. Therefore, it was judged that that effort should continue to be invested in the research program itself.

Senator THURMOND. Thank you very much, General, and I wish you well in your work. I think your work is extremely important, and I think you are doing a mighty fine job.

I did have one more question. Do I have another minute?

Senator EXON. Go ahead.

PHASED DEPLOYMENT APPROACH

Senator THURMOND. General, if the President decides in favor of a phased deployment approach, should there be any more or less emphasis on the nuclear directed energy research being conducted by the Department of Energy?

General ABRAHAMSON. I think the answer is that, no, we cannot slow down that effort. It is a serious effort, and it is done in this context.

First, we know the Russians are aware of these concepts and may be pursuing them. We also know that they may have very significant implications for our offensive forces today if the Russians use them in an SDI kind of system. And if some of the concepts meet their theoretical promise, it may even be worthwhile to examine and to say that their promise is too great that they offset the President's initial decision, which is a good decision and one that I think we all accept that this point.

But we should have the information so that that decision can be made and made explicitly.

[Deleted.]

Senator EXON. Thank you.

Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

General, will the early phase, phase one, meet the Nitze criteria?

General ABRAHAMSON. I do not think we have completed all of that. Obviously we are working on trying to see that it can meet that kind of criteria.

Senator LEVIN. Let me ask it a different way. My time is so limited, I would appreciate it if you could give a brief answer.

Is it intended that phase one meet the Nitze criteria?

General ABRAHAMSON. We are testing what might be phase one. I would like to see that it is possible. On the other hand, if the military imperative is important enough, then I believe that that would be discussed clearly with the Congress before a decision were made to deploy.

Senator LEVIN. Let me try it again. Has it been decided whether phase one meets the criteria?

General ABRAHAMSON. No, it has not, sir.

Senator LEVIN. Pardon?

General ABRAHAMSON. No, sir, it has not.

Senator LEVIN. So it has not been decided whether phase one will meet the Nitze criteria. Right?

General ABRAHAMSON. That is correct.

Senator LEVIN. Now on phase one——

Senator WILSON. Mr. Chairman, would the gentleman yield?

Senator LEVIN. Yes.

Senator WILSON. I think in fairness, because there has been some debate about this on the Senate floor, that the question really sort of requires definition. We can say that the Nitze criteria refers to being cost effective at the margin.

Senator LEVIN. I was talking about the four criteria.

General ABRAHAMSON. Oh, I am sorry. I did not understand that. I thought you were referring only to cost-effectiveness at the margin, sir.

Senator LEVIN. There are three Nitze criteria. You can answer that for the record.

General ABRAHAMSON. Yes. I would like to answer that for the record, if I may.

[The information follows:]

Since the overall objective of the SDI remains unchanged, we continue to believe that the defense resulting from the various increments must be expected to meet the basic criteria which the President has identified for strategic defenses: military effectiveness; survivability; and cost-effectiveness at the margin. The criteria for survivability and cost-effectiveness provide needed protection against instability; therefore, they must be appropriately applied to all options considered. On the other hand, while the criterion of military effectiveness should also be applied, it certainly cannot require that an option design to provide incremental capability be expected to achieve the full objective set for the program. Instead, any option design to provide incremental capability should clearly add an element upon which the larger, integrated system can continue to be built and, in the process, perform a militarily useful function which contributes an increase in our security commensurate with the commitment of resources involved.

Senator LEVIN. Is that all right, Pete?

Senator WILSON. Yes. I just think it ought to be more precisely defined.

General ABRAHAMSON. I am sorry. I misunderstood that. I will answer that for the record.

Senator LEVIN. Well, if it was just one, it would say "criterion," being an old Latin student.

General ABRAHAMSON. Perhaps I did not hear that quite as well as I should have, sir. Old jet pilots begin to lose their hearing.

Senator LEVIN. What is that?

General ABRAHAMSON. Old jet pilots.

Senator LEVIN. General, if the Soviets launched an all-out ICBM and SLBM attack, what percentage of the [deleted] RVs would your

first-phase system destroy? Give me a rough estimate. Can you give me a simple 10 percent, 20 percent, 50 percent answer? And could you then do it for the record?

General ABRAHAMSON. Yes, sir, we will provide it for the record.

[The information follows:]

SOVIET ICBM/SLBM ATTACK

General ABRAHAMSON. The currently envisioned architecture, as we have presented it to the Defense Acquisition Board, would destroy about [deleted] of the 11000-warhead threat you postulated. This same defense would destroy approximately [deleted] against which it was designed to operate.

However, "warheads destroyed" is not the most useful metric with which to assess this defense configuration. [Deleted.]

Defense like those we have proposed would change this picture. Against the "design threat," approximately [deleted] could be expected to survive. The assets saved would include [deleted]. The availability of a credible first-strike option would be denied the Soviets, and deterrence of Soviet nuclear attack would be strongly enhanced.

Senator LEVIN. There is no simple answer to that question?

General ABRAHAMSON. There is not a simple answer. It depends on the structure of the attack.

Senator LEVIN. OK. Thank you.

SUPPORTING SDI DECISIONS

General, you said I think the last time you were here that it was your goal in the program to provide sufficient information to support strategic defense decisions in the early 1990s.

General ABRAHAMSON. Yes, sir.

Senator LEVIN. Is that still your goal?

General ABRAHAMSON. Of course it is. But it is also a goal, if we can make that decision earlier, to be able to do so.

Senator LEVIN. Is it your goal to now provide sufficient information to support strategic defense decisions in the late 1980s?

General ABRAHAMSON. Sir, it is my responsibility to take whatever money is available and made available by the Congress, and to try to conduct this program as efficiently and as effectively as possible. And to get to that point——

Senator LEVIN. I understand that. But do you phrase that the same this year as you did last year?

General ABRAHAMSON. That is right.

Senator LEVIN. You would?

General ABRAHAMSON. Because last year, as we were looking at it, and as I was looking at that overall program, I thought we could still do it by that timeframe, by the early 1990s. But it is also clear that if we can do it better, that is better for the country, is it not? Does that not allow us to be at a point where we can make a decision, hopefully with less investment, but a meaningful decision.

Senator LEVIN. Is it fair to say that you would not phrase your statement the same way this year as you did last year? Is that a fair statement?

General ABRAHAMSON. That is a fair statement. But I believe, sir, the way the question was asked last year, or at least the way I intended to answer it, was could we make that decision by the early 1990s, and I thought that we could. And what I am saying now is that I still think we can, even though we have had money that has

been reduced. And obviously if we can make it better, then that means that the people out there who are doing this marvelous job have been even more efficient and effective than we thought.

Senator LEVIN. For the record, then—Mr. Chairman, first of all, can the record be kept open not just for unclassified—I mean for classified questions, but for unclassified questions?

Senator EXON. I know of no reason why not.

SDI BREAKTHROUGHS AND ADVANCES

Senator LEVIN. For the record, could you provide for us a list of all of the breakthroughs and unexpected advances since last year? I think you listed three breakthroughs here today. Could you list for us for the record all of the breakthroughs and the unexpected advances since last year, and what was the expectation last year compared to how it looks now. Could you supply that for the record?

General ABRAHAMSON. That is a very—that is a whole report. I gave you the three breakthroughs. I can provide, for example I did provide in that book, an example of the progress that has been made in space-based kinetic kill vehicles, and it explains that.

I have similar books that are being put together for other projects. If I can be responsive to your question by providing those books over what will be a period of time, I will try to do that, sir.

Senator LEVIN. That is fine.

Thank you, Mr. Chairman.

Senator WIRTH. Mr. Chairman, just by way of the open questions, I would like to follow up on the question I was asking about spinoffs and the effect on the defense industries. They probably are classified. I would think the SDIO would like to make the case about spinoffs. So I will submit appropriate questions for the record, if I might.

Senator EXON. I would say to both Senator Levin and Senator Wirth, you have 24 hours to get those questions in if you want to submit them. So if you have not articulated the question here, please submit them within 24 hours.

Senator WIRTH. Thank you.

Senator EXON. Senator Wilson.

Senator WILSON. I think I will yield to the chairman.

Senator EXON. I assume that this book is unclassified. Is that correct?

General ABRAHAMSON. Yes, sir, that is an unclassified book.

Senator EXON. Thank you very much.

I would hope that you could provide the answers for the record by the close of business by Monday, April 30. I understand the procedures and I know that a lot of this is difficult, but if you can, by that time would be most helpful to us.

General ABRAHAMSON. Sir, I understand the admonition, and we will do our best.

HEAVY LIFT LAUNCH VEHICLE

Senator EXON. One question, and then a statement.

General Abrahamson, is it not true that the only requirement—I repeat, the only requirement—for a heavy lift launch vehicle prior

to the very late 1990s is for an SDI early deployment phase? Is that not correct?

General ABRAHAMSON. Well, I do not believe so, sir. We have studied with NASA and with the Air Force representing the other security requirements of the Nation, and we have documented there their estimates of the kinds of requirements there might be after 1995, and they are after the 1995 timeframe, and that is quite clear.

I think the key point here is, is it a requirement or an opportunity? NASA feels that, while they cannot at this point say that they must have a heavy lift launch vehicle in order to proceed with the space station, that that would be jeopardizing the space station, that therefore they do not state that as a requirement.

But if they had confidence that a heavy launch vehicle were available, or would be available in the right timeframe, there are estimates of how that might reduce either the logistics support, or perhaps even simplify some of the development of the program.

So while an SDI requirement certainly is the driving requirement, I believe that it is a national requirement. At this point, the Soviet Union in a year or two will be the only nation that has a heavy lift launch capability, which with all of the potential that has, and they will probably have that—we do not know for sure—but I would say within the next year or two.

When I presented, if you noticed that one chart about a phased deployment, it says "requires a heavy lift launch vehicle." I presented to Secretary Shultz that overall program and indicated to him that I thought that to proceed with a heavy lift launch vehicle was also the single most important signal that we would give to the Soviets that we are serious, and that they had better get serious about their negotiations, and it would be one that is unencumbered by all of these arguments or concerns about treaties and all of those kinds of activities.

I believe that the Secretary not only understood that, but endorsed that. So that the requirement is not only a real requirement of the system, and it is a real requirement, but I think that it also enhances our national effort for both leadership, and to provide motivation in the arms control arena, as well.

Senator EXON. Well, I listened to you very carefully. I guess, though, so far as SDI is concerned, the only real reason for a heavy lift launch vehicle before the late 1990s would be for an earlier phase deployment than we had originally anticipated.

General ABRAHAMSON. Well, I have always felt that we could have the beginning of a phased deployment in the mid-1990s.

Senator EXON. General, I do not mean to belabor this point.

For the record, when can we expect the reports that are already due on this whole system? No. 1, the SDI Report to Congress, Section 223, which was due March 15; the SDI Countermeasures, due March 15; the Effective Less Restrictive ABM Treaty Interpretations on SDI, due February 1, and we have had a little conversation on that today; SDI Deployment Schedule, due March 15; Projected Costs of the SDI Program: Preliminary Analysis, due on March 15; and the Interim Assessment of SDI Computing Requirements, due with the fiscal year 1988 SDI budget request.

Is your answer different than the one that I would expect?

General ABRAHAMSON. Well, it will be as soon as possible, sir, with one exception. By the way, the overall SDI report exists. It is very nearly complete. But, as always, because that has so much significance not only to SDI but to our overall interests in the Department of State, our policy interests, coordination does take time and effort, and that is why that was delayed this year, and that may be why it is in the end delayed additionally this year.

The other reports are more straightforward, with one exception. That is, the one on the implications of the treaty to the testing program. As I have indicated, we owe a very detailed report to the President on the 30th of April, and I do not believe that we will be in a position to provide detailed information to the Congress, although I can provide examples as I did today of the issue, but an overall report on that prior to the time that the President has the opportunity to see it.

Senator EXON. I was ready to let you off the hook by saying as soon as possible, but are you responding to my question that you are going to ignore all these requests that the law dictates until after you report to the President on April 30? Is that what you said, in other words?

General ABRAHAMSON. No. What I said was——

Senator EXON. I thought that was what you said.

General ABRAHAMSON. What I said was——

Senator EXON. I want to get out of here, but why do you not say it again so that I can understand it.

General ABRAHAMSON. OK. I guess my problem is I work very hard to try to communicate just as effectively as I can and as completely as I can.

Senator EXON. I agree, and I compliment you on that. But I understood you to say that we would not get any answers to these reports that are already past due until April 30. If that is your answer, then I accept that, but that is not what you said?

General ABRAHAMSON. No, sir. We are trying to get every one of those reports over as quickly as possible. The one that I believe will probably be the most delayed is the one on the implications of the treaty.

Senator EXON. Senator Gore, we were about to close down, but would you like to ask——

Senator GORE. No questions.

Senator EXON. Senator Wilson.

Senator WILSON. I have a question that is fairly consistent with the point that you have just made of having difficulties meeting the reporting requirements that we have imposed. It might make a small contribution, but however small it will probably be appreciated. A good deal of the questions that were asked here today dealt with unclassified material. I wish the questions that I asked of General Abrahamson and his replies could be part of the unclassified record. Unless staff comes up with some objection, I will so request. That will save you from having to ask the same questions.

Senator EXON. Do you have any objections to that?

General ABRAHAMSON. No, sir. That is fine.

Senator EXON. Thank you, Senator.

Senator WILSON. Thank you.

Senator EXON. Well, here we go again. If you will simply tell us what all of the unclassified answers are—it might be better, Senator Wilson, if it is possible for your staff to get the questions that you think should be published, and ask that question in public when the General will appear.

I mean, I do think it is important that we get some of this information out to the public. We hold these meetings, but the public is entitled to information. I think you have been very forthcoming, General, so far as the public is concerned. Rather than go through all these questions, would it be unreasonable to ask your staff to pick out the questions that you thought were important, and you could ask those in public? Would that solve the problem? Without them having to go through all of this?

Senator WILSON. When will the General be back before us? April 1?

Senator EXON. What is the date? April 1.

Senator WILSON. I suppose a few more days will not deprive the public unduly, so I will just ask the questions again.

Senator EXON. Thank you, Senator.

Senator WILSON. Thank you, Mr. Chairman.

Senator EXON. Senator Gore.

Senator GORE. Thank you, Mr. Chairman. I appreciate it.

General, since the hour is late, I would appreciate brief responses, and I will reciprocate with brief questions.

General ABRAHAMSON. OK.

Senator GORE. Is it true that at the current time you have no answer whatsoever for the threat [deleted]?

General ABRAHAMSON. I do not think we have a final answer.

Senator GORE. Do you have any?

General ABRAHAMSON. I think we have some, yes.

Senator GORE. Do you have any promising leads?

General ABRAHAMSON. Yes.

Senator GORE. What are they?

General ABRAHAMSON. They cannot be talked about in this forum, sir.

Senator GORE I thought this was a top secret—we are at the top secret level here, are we not?

General ABRAHAMSON. I am sorry, but it cannot be commented on.

Senator GORE. Well, I will look forward to pursuing that at the appropriate level. But the technologists that I have been talking to, and of course there are plenty in this area—some know what they are talking about, and some of them do not—but the ones I have been talking to say that you all have made just no progress at all against the threat [deleted].

If it turns out that the leads you presently have are not developed in a promising way, and it looks as if each one of these battle stations is vulnerable [deleted], and therefore it is not cost effective or survivable under the Nitze criteria, would that mean that you would not go ahead with the first phase?

General ABRAHAMSON. Well, the first point is you are starting with a whole set of assertions [deleted].

I do not accept your assertions, and I think that there are in fact ways to deal with exactly that.

Senator GORE. Do you think it is reasonable to assume that an object put into orbit which has the function of [deleted] do you think it is reasonable to assume that that is going to be cheaper than an object that has computing power, can defend itself, can launch projectiles at hitherto unheard-of velocities, and lots of them, I mean it seems like a reasonable assumption that [deleted] is going to cost less than one of these garages for kinetic kill vehicles. Does that not strike you as a reasonable assumption?

General ABRAHAMSON. Yes, it is, provided [deleted] can be made to work against either electronic countermeasures, or some of the other kinds of things that one might begin to work on.

Once again, I hope that what I showed you in terms of the ASAT threat, that it is much more complex than the assertions that have been made, and I believe that the same principle applies here, and therefore I just do not accept that it is that simple.

Senator GORE. Well, in the presentation I thought you made some very interesting points on the ASAT threat, but I followed the presentation very closely, [deleted].

General ABRAHAMSON. That is right.

Senator GORE. Now I am asking you an admittedly hypothetical question, but the purpose of the question is not to get in a dig at the program, the purpose of the question is to illuminate how the Nitze criteria applies to phase one, as opposed to the eventual program in and of itself.

Hypothetically, if you did not find an answer to [deleted] would that trigger the Nitze criteria——

General ABRAHAMSON. Sure.

Senator GORE [continuing]. In a way that prevented deployment of phase one?

General ABRAHAMSON. Well, I think that it would surely trigger a very careful examination, and a careful examination would be, can the Russians build them? Can they put them up? How soon would we see them? I think that is much more complex than what you have just suggested.

You assumed the answers to all of those.

Senator GORE. Well, because I am asking a hypothetical question.

General ABRAHAMSON. Well, I understand that.

Senator GORE. That is why. And frankly, the hypothetical approach arises from some concern that the application of the Nitze criteria will be fudged, and that assertions about the complexity of using these very sensible criteria will be allowed to substitute for a hard-nosed application of the criteria themselves.

I am not saying that in an accusatory way. I am being honest and telling you that that is my concern, that in terms of intellectual honesty, the Nitze criteria make a lot of sense, but I am concerned that those who are most enthusiastic about the program may find a way to fudge that.

Now the second point. Is it true that you originally supported the shuttle ride vehicle for the lift capacity, rather than a heavy lift vehicle?

General ABRAHAMSON. No, there is a fundamental requirement that I think the Nation needs a proper balance between something that will be as low-cost as possible, and I set a very demanding goal, and it was my goal that became the basis for the Interagency

Studies that were made. That was, to see if we can reduce the costs of space transportation by tenfold. I think that that is a very, very critical element.

But cost is not the only parameter. We also have to have in fact reliable kinds of operations, and flexible operations. I can assure you, having lived through the problems of 10 shuttle launches, that I know exactly what that means.

We must have that kind of capability, along with low cost. I never felt that a shuttle-derived launch vehicle is the only answer. It is a potential answer. There are a whole range of potential answers out there.

I believe the way we should proceed is to examine all of the technologies in competition, and then see which ones will survive.

Senator GORE. I only have one other question, Mr. Chairman.

SHUTTLE-DERIVED VEHICLE

That last point is directed to an option that the committee may wish to consider. That is, a shuttle-derived vehicle which gives us a big increase in the current lift capacity, but not as much as the heavy lift vehicle. If you want to respond further for the record on the point of how much an improvement the shuttle-derived vehicle might be for you, I would welcome that.

One short comment, followed by a question.

When the observers were in Geneva recently, two separate Soviets on their delegation asked the question, is the report on—is the list of tests relevant to strict versus broad going to be made public? I just say that for your information, because obviously they are anxious to get a bead on exactly what that list is. I take it that you—do you intend for that to be public, or not?

General ABRAHAMSON. If you will remember, we publish our annual report in two separate volumes. One is a classified volume which provides a lot of additional information about those tests, and then one which is an unclassified volume which is less significant.

I find it of great interest that the Soviets are following our program so carefully, and I would be delighted if you are successful in getting one of those kinds of lists from them on their programs.

Senator GORE. The fact that they were so interested in ours made me think that maybe we ought to do our best to keep that secret from them.

General ABRAHAMSON. Yes.

Senator GORE. Now my final question. [Deleted.] You also said in passing, if these battle stations—what do you call them?

General ABRAHAMSON. Well, these are called "carrier vehicles."

Senator GORE. If these carrier vehicles have the ability to maneuver, it greatly complicates the task; if they have the ability to defend theirself against ASAT, then it greatly complicates their task.

Am I correct in assuming that the system you are presently designing does not—would have carrier vehicles with neither of those capacities?

General ABRAHAMSON. No, that is not correct, sir.

Senator GORE. Now where did I get that impression? It was something about the removal of one critical sensor.

General ABRAHAMSON. Perhaps it is the way I described it. In our initial what we called phase-one studies, we in fact looked at several options. [Deleted.] So in terms of the requirements and the way we have structured that particular system, those are decisions that are made, although some of the final tradeoffs between how much maneuvering versus how much hardening and that, are still yet to come through the first phase of the system research program that I have outlined here.

So, no, those requirements are clear.

Senator GORE. Very good.

Thank you very much.

Senator EXON. Thank you, Senator Gore.

General, thank you very much for being so patient and for being such a good witness, as you always are. We appreciate your coming over.

[Questions for the hearing record, with answers supplied follow:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

SDI TECHNICAL GAINS

Senator LEVIN. General, in February of this year, you told the House Armed Services Committee: "We are now 5 months into our third fiscal year of the program. In that brief period we have made many technical gains which far exceed even my own optimistic assessment of what could be achieved."

(a) Specifically, just what technical gains have you made which exceed even your own optimistic estimate of what could be done? When were these great technical gains made, and in what fiscal year was each such gain funded?

(b) Are those technologies in which you report great progress also those which are widely considered to be "near term" technologies?

(c) If the answer to (b) is yes: Was that progress made possible primarily because you have reconfigured, and continue to reconfigure, the SDI program with an emphasis on near term deployable technologies? Will a near term deployable system based on those technologies provide a thoroughly reliable defense of our population?

General ABRAHAMSON. (a) This question can best be answered by the SDIO's Annual Report to Congress for fiscal year 1987.

Specifically, in each chapter dealing with technologies there is a section entitled "Significant Accomplishments", which outlines the essential and outstanding progress that has been made in various areas. A majority of these technical gains has been accomplished, not in one fiscal year, but over a span of several years using funds from more than one fiscal year. In some cases, the research predates the creation of the SDI. Obviously, progress is cumulative, in that outstanding advances made today are possible only as a result of previous years of successful research. This emphasizes the importance of adequately funding this program and maintaining from year to year the level of funding necessary to build a solid research base for future development and deployment decisions.

(b) No. Significant progress has occurred, not only in those technologies which could be deployed as the initial elements of a phased deployment, but across the whole spectrum of SDIO research activities.

(c) No. This question incorrectly implies that we have reconfigured our program to emphasize near term deployable technologies. That is not the case. As I have said before, we believe the key to achieving a thoroughly reliable and effective defense is the pursuit of a balanced program, involving a combination of short term and longer term options. Not only must validation of the more mature and promising technologies be completed to facilitate making an informed development and deployment decision, but we must also aggressively pursue a technology base research effort to establish the feasibility of our most advanced defense concepts. This is the only way we can take full advantage of the opportunity to anticipate increased Soviet offensive and defensive capabilities, and provide the needed strong incentive to decrease our reliance on offensive systems.

Conducting the balanced program I have just described will allow us to pursue a phased, or incremental, deployment. In such a defense, the development and deployment of the initial phase of an evolutionary system would provide a base upon which the larger, integrated system could continue to be built. Each phase of deployment would be given sufficient capability to achieve specific military and policy objectives and lay the groundwork for the deployment of subsequent phases. With respect to this approach, our three criteria for a thoroughly reliable and acceptable defense have not changed. We continue to insist that the defense resulting from the various increments in a phased deployment meet our basic criteria of military effectiveness, survivability, and cost-effectiveness at the margin.

IMPACT OF CUTS

Senator LEVIN. General, last year you told our committee that "the impact of cuts of that order of magnitude ($1 billion) again would be an appreciable change in either the schedule or the very appreciable reduction in the amount of confidence in some of the tests . . .".

Here we are, a year and a $1.9 billion cut later, twice the magnitude you warned against. What has been the impact of that cut? Was it an appreciable change in the schedule, or a very appreciable reduction in our confidence in some of the tests?

General ABRAHAMSON. Large budget reductions from the fiscal years 1985 and 1986 requested levels caused a reduction in the number of promising technologies being pursued in parallel and increased the difficulty of realizing adequate solutions to specific technical issues. The further reductions made in 1987 have placed the SDI Organization in a position where simply scaling back alternatives is no longer viable. The progress of some portions of the SDI Program has been slowed approximately 1 to 2 years. The SDIO has, in essence, slowed its rate of progress on some technologies needed to hedge against potential Soviet countermeasures. The SDIO has focused on the technologies that could be used to sustain performance growth to increasing levels of defense, but effort on some technology candidates has been either reduced or eliminated.

SDI TEST SCHEDULE

Senator LEVIN. General, last month, in response to a question on the SDI test schedule, Secretary Weinberger told this committee: "I would think that it should be an integral part of your deliberations to know essentially what it is that we plan to do, what we can do, and what we could not do." (2/17/87).

I agree wholeheartedly. We need to know in detail what your test and experiment schedule is for fiscal years 1987, 1988, and 1989 before we mark-up the Authorization bill. We need to know if your tests and experiments will unambiguously comply with the traditional interpretation of the ABM Treaty in fiscal years 1987-88-89 before we mark-up the Authorization bill.

Are there any tests, experiments, or other SDI activities currently configured so as to violate the traditional interpretation of the ABM Treaty?

Please provide the committee with a list of all those tests, experiments or other activities which would be conducted outside the traditional interpretation in fiscal years 1987-88-89 were the administration to decide to operationally adopt the "broad interpretation".

As Secretary Weinberger suggested, we have to have that information before we markup beginning the week of April 21. Please provide it by that date.

General ABRAHAMSON. The SDI research is being conducted in a manner fully consistent with all U.S. treaty obligations. In October 1985, the President directed that as a matter of policy the SDI program be conducted according to a more restrictive interpretation of the ABM Treaty than the U.S. could justifiably observe. Statements regarding compliance with treaty provisions should be understood to be based on the more restrictive interpretation. SDI projects and experiments are reviewed to ensure that they will be conducted in accordance with the activities permitted by the treaty. The Annual SDI Report to the Congress, being published on April 21, includes a compliance assessment for the major experiments in the SDI program. The experiments addressed are: ALPHA, TPE, NPBTIE, AOA, SATKASIE, FLAGE, HEDI, TIR, SKYLITE, GBFEL, BSTS, SBKKV, JANUS, STMII, ERIS, LWIR Probe, and Hypervelocity Railgun.

Should the President direct that the SDI program be restructured to take full advantage of the broader bounds of the ABM Treaty, certain experiments may be redefined.

R&D SDI CONTRACTS

Senator LEVIN. General, last March 4, in reference to our cooperative R&D SDI contracts with our allies, you told the House Armed Services Committee that "most of the nations agree with and support this concept, that it ought to be done at least in this period of time within the ABM Treaty, and they also want assurance, and I think we owe that to them, both as a good business enterprise and also because they are our allies, that they understand what they are working on is a project that can legally and properly be worked on within the confines of the ABM Treaty."

If the administration operationally adopts the "broad" interpretation of the ABM Treaty, do you believe our allies will continue to believe that what they are working on can be legally and properly worked on under that treaty?

General ABRAHAMSON. We have assured our allies that SDI research is being conducted in a manner which is fully consistent with all U.S. international obligations including the ABM Treaty. Allies have fully supported this approach. Recognizing that the ABM Treaty is a bilateral agreement your allies have always looked to the United States as the rightful and legal authority in such matters. We issued an invitation to allies to participate in SDI research and made clear at the time that their participation is their choice.

Senator LEVIN. If we operationally adopt the "broad" interpretation, do you believe our allies will continue to participate in joint SDI research?

General ABRAHAMSON. The consultations with our allies which the President directed in order to reach a decision about restructuring the SDI program consistent with the broad interpretation are not yet complete. Nonetheless our allies have made clear to us that they believe the United States is in the best position to judge our legal obligations under the ABM Treaty.

SOVIET DEFENSE AGAINST BALLISTIC MISSILES

Senator LEVIN. Have the Soviets conducted any development and/or test activities in the air or in space which violate the traditional interpretation, as "Soviet Military Power" implies?

General ABRAHAMSON. The Soviets have an extensive program in advanced technologies for defense against ballistic missiles, including those based on "other physical principles." The Soviets have evidently assigned high priority, for example, to their military research and development program for high-energy lasers and are also pursuing research on kinetic energy and particle beam weapons. In view of the limitations in our information, a confident judgment is impossible as to whether or not the Soviets have progressed to the development stage with ABM applications for any of the above technologies. It is important to note, however, that Soviet activities in "traditional" ABM technologies include one clear violation of the ABM Treaty and other potential or probable violations. These activities include the development and testing of rapidly deployable ABM components, the granting of ABM capability to air defense surface-to-air missile launchers, and the construction of a modern, redundant large phased-array radar ballistic missile detection and tracking network. Taken together, these "traditional" ABM activities suggest that the Soviets may be preparing an ABM defense of their nation.

Senator LEVIN. Were the Soviets to operationally adopt the "broad" interpretation of the treaty, what effect would that have on their ballistic missile defense efforts? How much more quickly could they develop a nationwide breakout potential if they adopted the "broad" interpretation?

General ABRAHAMSON. The Soviets have an extensive program in advanced technologies for defense against ballistic missiles, including those based on "other physical principles." The Soviets have evidently assigned high priority, for example, to their military research and development program for high-energy lasers and are also pursuing research on kinetic energy and particle beam weapons. In view of the limitations on our information, a confident judgment is impossible as to whether or not the Soviets have progressed to the development stage with ABM applications for any of the above technologies. It is important to note, however, that Soviet activities in "traditional" ABM technologies alone suggest that the Soviets may be preparing an ABM defense of their nation. These activities include the development and testing of rapidly deployable ABM components, the granting of ABM capability to air defense surface-to-air missile launchers, and the construction of a modern, redundant large phased-array radar ballistic missile detection and tracking network.

SDIO RED TEAM

Senator LEVIN. How much money was authorized for the SDIO Red Team in fiscal year 1986 and fiscal year 1987?

General ABRAHAMSON. SDIO Red Team funding for fiscal year 1986 was $7.2m. (Note, the Red Team is part of an overall countermeasure assessment program which was funded at $25.1M in fiscal year 1986.) SDIO Red Team funding for fiscal year 1987 is $7.9M.

Senator LEVIN. How much money is planned for the SDIO Red Team in fiscal year 1988 and fiscal year 1989:

General ABRAHAMSON. SDIO Red Team funding planned for fiscal year 1988 is $8.8M and for fiscal year 1989 is $9.2M.

Senator LEVIN. Who is the head/director of the SDIO Red Team effort now? Have other people headed this effort in the past? If so, who are they?

General ABRAHAMSON. Dr. Keith A. Taggart is the director of the SDIO Red Team efforts. Dr. Taggart has no predecessors in this effort.

Senator LEVIN. What outside consultants and/or contractors are involved in the Red Team effort?

General ABRAHAMSON. The attached listing includes all outside consultants/contractors.

LIST OF SUBCONTRACTORS

AVCO Systems Division, 201 Lowell Street, Wilmington, Massachusetts 01887;

AT&T Technology Systems, c/o Bell Telephone Laboratories, Whippany, New Jersey 07981;

Applied Research, Inc., P.O. Box 11220, Huntsville, Alabama 35805;

Booz-Allen & Hamilton, 4330 East-West Highway, Bethesda, Maryland 20814-4455;

Electronic Warfare Associates, Inc., 2071 Chain Bridge Road, Vienna, VA 22180;

Ford Aerospace & Communications Corp., Ford Road, Newport Beach, California 92660;

General Research Corporation, 5383 Hollister Avenue, P.O. Box 6770, Santa Barbara, California 93160-6770;

The Harris Group, Inc., 1761 Business Center Drive, Suite 200, P.O., Box 3509, Reston, VA 22209;

Craig W. Hartsell, Inc., 12291 Kosich Court, Saratoga, California 95070;

Hoebercorp, 5151 Williamsburg Boulevard, Arlington, Virginia 22207;

Jamieson Science & Engineering, Inc., Suite 447W—Air Rights Building, 7315 Wisconsin Avenue, Bethesda, Maryland 20814;

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WHITE TEAM REFEREES

Senator LEVIN. Who are the people that make up the so-called "White Teams" of referees who oversee the Red Team vs. Blue Team exercises?

General ABRAHAMSON. See attachment.

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QUESTIONS SUBMITTED BY SENATOR TIMOTHY WIRTH

Senator WIRTH. It has been argued that the portion of the SDIO budget devoted to basic and applied research is not directed at technologies with broad, general applications. In your view, what is the potential applicability of the results of basic and advanced SDI research for DOD and the commercial sector?

General ABRAHAMSON. By its very nature, our basic research seeks to explore and develop new scientific principles. It is difficult to predict how such basic work will benefit non-SDI applications. However, the fact is that much of the exploratory and advanced technology development stems from basic research. That there will be applications of such research in the SDI program to other DOD and commercial problems seems assured in light of such past examples as contributions to aircraft development, spinoffs from the Apollo program, etc. The SDIO Office of Civil Applications has been established to help make SDI research and technology available to other DOD and Federal agencies as well as business and research interests in the American private sector. Specifically, reapplication of the technology generated by the SDI promises a broad range of "spin-offs" that can add up to significant benefits in terms of human welfare, industrial efficiency, and economic value through tomorrow's practical application.

The earliest impacts of our efforts on the civilian sector are likely to occur in the areas of our energy/power programs (both space and ground) and the electronics and computer applications and materials and industrial processes associated with all of our efforts. Technologies developed in these areas will certainly make a significant contribution to commercial applications. Our space logistics program (lift, operations, and maintenance) will contribute significantly to the overall U.S. space program, and to the civilian sector to the extent that the space program does. Of course, we also have a dedicated, congressionally mandated effort in medical and materials research using low power, tunable free electron lasers for directly generating applications useful in the civilian sector.

SDIO'S "SPINOFF" EFFECT

Senator WIRTH. A great deal of emphasis over the years has been placed on the positive impact that Defense research and development has on the commercial sector, and this technology transfer has a significant effect on the economy in general. Can you provide an assessment of SDIO's "spin-off" effect on the economy, and provide some specific examples? Do you have in place within SDIO a specific plan to facilitate technology transfer? Do you have an office or individual assigned responsibility for technology transfer so that we may gain the full benefit of the money we are spending on SDI?

General ABRAHAMSON. Historically, both the Department of Defense (DOD) and the National Aeronautics and Space Administration (NASA) have significantly advanced the state-of-the art in science and technology and spurred the American economy by means of technology transfer from military and space programs. Through the various military service research and development agencies, NASA centers, and Federal laboratories, significant advances in technology and new inventions were transferred to the private sector that are standard consumer items of today and new products of tomorrow. Regarding the impact of spin-offs on the economy, NASA studies have indicated that for every dollar that was put into the Apollo program, $8 were returned to the U.S. economy in one form or another.

In view of the advances in technology being derived from Strategic Defense Initiatives research, an Office of Civil Applications has been established within SDIO to develop and implement a domestic technology transfer program designed to make SDI technology available to other DOD and Federal agencies as well as to business and research interests in the American private sector. Unclassified information regarding new technologies will be made available to qualified American corporations and small businesses, universities, and entrepreneurs as well as assistance in identifying the sources of new SDI technology in order to negotiate proprietary rights and patent matters. The Office of Civil Applications is developing a technology applications information system, and is using voluntary scientific and technical advisors from across the country to assist in the identification of SDI technology with spinoff potential. The program is also integrated with the activities and technical resources of the Federal Laboratory Consortium.

Some general examples of SDI technology that have potential for Civil Applications follow:

Computer data processing speed and efficiency enhancements through improved components, circuitry and software.

Electronic components which are lighter, smaller, more capable and energy efficient.

Software with artificial intelligence that would allow computer systems to learn from experience and be able to make realistic deductions.

Optical computing using laser light instead of electrical circuits for data transmission and other optical applications.

Electrical power systems which are more efficient and less expensive.

Sensors which are lighter, smaller, more sensitive, and less expensive for medical, manufacturing, research, control systems, and a host of other applications.

Cryogenic cooling systems which are lighter, smaller, more efficient.

Light-weight mirrors with computer-controlled adaptive alignment for laser applications to manufacturing processes.

Electrical systems hardening techniques applicable to reduction or elimination of noise and other interference in communications systems and to allow continued use of electronic devices in hospitals for monitoring patients when strong magnetic fields associated with magnetic resonance imaging diagnostic equipment is in use.

Tracking and pointing technology developed for surveillance may be valuable in applications to commercial aircraft guidance and control and ground traffic monitoring.

Tomography associated technology which may enhance medical techniques for location and discrimination of soft tissue abnormalities.

Free electron laser applications to non-invasive cancer surgery, early diagnosis and treatment of heart disease and stroke, and other medical diagnostic and treatment applications.

Integration of laser technology, robotics and computerized precision control techniques into applications associated with a host of manufacturing processes, and biomedical applications.

The SDIO Office of Civil Applications is in the process of identifying technologies with spinoff potential in order to promote promising marriages of technology and domestic applications deemed to have a high pay-off potential in the near term. Although such projects are not funded from the SDIO budget, the Office of Civil Applications will seek to advance promising programs through encouragement of successful partnerships among entrepreneurs, inventors, and venture capitalists. Some specific examples of the current activities in this area follow:

Sol-Gel Derived Bioglass: A bio-active material that has the capability of replacing or repairing human bone and soft tissue. SDI research at the University of Florida in materials processing technology for rapid fabrication of optical devices resulted in a method to extend this bio-technology into a host of new applications that should result in many new types of bio-compatible prostheses. In the first meeting of the SDIO Bio-Medical Applications panel, it was determined that this new material promises a dramatic improvement with another new bio-medical innovation—the Programmable, Implantable Medication System (PIMS) which itself uses satellite telemetry technology and NASA Mars Viking Lander technology to automatically dispense insulin for diabetics.

Diamond Crystal Coating Technology: Developed under the SDI Diamond Technology Initiative Program for the coating and protection of mirrors, electronics and other devices in space, this new process for depositing thin layers of diamond crystal on surfaces has numerous potential applications: Protection of eyeglasses, windows, mirrored surfaces; surface hardening of cutting, grinding, manufacturing tools and machinery; acoustical speaker application—a technology spinoff that is currently being marketed by the Sony Corporation; Manufacture of microminiature surgical instruments from micro circuit technology, coated with diamond crystal to produce super sharp microsurgical instruments for eye surgery.

Earth Atmospheric Data: Data derived from studies of the earth's atmospheric characteristics associated with the performance of directed energy defense systems is being shared with NASA and NOAA to enhance overall geophysical, atmospheric, and meteorological research.

High Speed, Fault-Tolerant Computer Applications in Medicine: High speed computer processors and programs of the SDI Gallium Arsenide program are being made available to the medical community through the Mayo Clinic to enhance the study of model molecular structures essential to the derivation of new designer drugs.

Computers used in operating rooms currently can fail with life-threatening and potentially fatal consequences. Applications of the SDI Gallium Arsenide Advanced On-board Signal Processor provides computing technology designed to degrade gracefully without total shutdown. Applications are being explored by the Mayo Clinic.

Optical Tracking Applications to Eye Surgery: SDI technology for Optical tracking of ballistic missiles and warheads has potential application to tracking the rapid random movements of the eye to enhance eye surgery with lasers.

Other Spinoffs: Examples of other devices and processes that have been identified in an initial research effort by the bio-medical and power generation technology applications panels include:

Microminiature, gas-powered refrigeration devices with applications to food preservation, industrial processing and materials manufacture, and super conductors.

Photolithographic Processes for Micro Fluidic Devices with applications in industry, medicine, and aerodynamics.

High Power Density Alkaline Fuel Cells which can use ambient air in lieu of exotic fuels and are adaptable to long term power needs at remote sites or for back-up systems.

Monolithic Solid Oxide Fuel Cells with no moving parts that can use gasoline, jet fuel, and methane gas with efficiencies twice that of conventional automobile engines.

Multi-Layer Ceramic Processing techniques that can combine the characteristics of electrical, thermal and mechanically-active properties in one material.

Super Capacitors with over 20 times the capacitance or energy storage capability of current technology.

Attentive Associative Memory Software which permits a high degree of artificial intelligence self-programming capability for computers.

Cryogenic alternators which have a 40% increase in power output per unit weight and are more simple, reliable, and inexpensive than current devices.

High power super batteries which may be spun off to lightweight more powerful uses in the auto industry, powered wheelchairs for handicapped, etc.

Superconductor Materials with applications to superfast computers, low power electronics & appliances, and transportation systems.

Hypercube Parallel Processing Techniques for high speed large scale computing problems such as FAA air traffic control applications.

Advanced Thermoelectric Cell for conversion of heat to electrical power.

The reapplication of the technology generated by SDI thus promises a broad range of spinoffs that can add up to significant benefits in terms of human welfare, industrial efficiency and economic value through tomorrow's practical application. It is our hope that the benefits of SDI technologies can bring a significant enhancement in America's productivity and competitive position in the international market place.

SDIO RELATIONSHIP WITH UNIVERSITY COMMUNITY

Senator WIRTH. What kind of relationship does the SDIO now have with the university community in the United States? How much of SDIO's funding is being spent with universities? Can you make a general assessment of the impact the SDI program is having on our universities?

General ABRAHAMSON. After 3 years of programs sponsored by SDIO at American universities, the general consensus among university presidents, research administrators, and academic scientists involved with the program is that the SDIO is an agency that they can do business with. Many of the early predictions by critics of loss of academic freedom, classification of campus research, and restrictions on foreign graduate students working on unclassified projects have been demonstrated to be incorrect. While there is still opposition from some in academic circles, it represents a minority of professors in the scientific, engineering, and computing departments throughout the research institutions in this country.

The following data represents the extent of our work with universities.

[Dollar amounts in millions]

	University dollars	University contracts	Universities involved
Fiscal years:			
1985	$14	88	60
1986	51	150	110

[Dollar amounts in millions]

	University dollars	University contracts	Universities involved
1987	65	180	115

This is about 2 percent of the total SDIO funding. The impact of the SDIO program on universities is both large and small. Small in the sense that the total SDIO dollars for basic research at universities is about 10 percent of the total DOD portion and about 1 percent of the total U.S. Government contribution, with NASA, NSF, DOE, and NIH all contributing more than 10 percent of the total. In addition, a recent National Academy of Engineering report states that increases in DOD research budgets are unlikely to create shortages in manpower for nonmilitary needs. The impact is large in that SDIO contracts represent the only really new money for research recently. Because of the new program (no "old boys" network has been established), new researchers have a greater chance of being funded with new, innovative ideas. Much of the SDIO money is going toward purchases of new equipment upgrades in university laboratories with outdated materiel. Finally, because of the nature of certain high-risk/high-payoff research funded by the SDIO office, many very innovative ideas which would not receive support from existing agencies are being funded. This will allow many technologies to leapfrog into 21st century science within the next decade due to this investment strategy.

SDIO BUDGET IMPACT

Senator WIRTH. A program with a research budget as large as the SDIOs certainly must have an impact on the scientific and engineering manpower pool. Is there any evidence that there is a shortage of scientists and engineers in the commercial sector?

General ABRAHAMSON. SDIO has not specifically looked at scientific and engineering resources. However, the House Appropriations Committee did study this over a year ago. Their report was classified (not by DOD, but by the HAC). I am sure that it can be made available by contacting the House Appropriations Committee. I believe the essence of the study was that no major problems would exist.

Senator EXON. We are adjourned.

[Whereupon, at 5:33 p.m., the subcommittee was adjourned, subject to the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, MARCH 26, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

ANTISATELLITE CAPABILITIES

The subcommittee met in executive session, pursuant to notice, at 8:40 a.m. in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Levin, Warner, Thurmond, Quayle, and Wilson.

Staff present: Carl M. Smith, staff director for the minority; Robert F. Bott, Judith A. Freedman, William E. Hoehn, Jr., Ronald P. Kelly, professional staff members; and Mickie J. Gordon and Pamela G. Powell, staff assistants.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Donald A. Mitchell, assistant to Senator Glenn; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order. The Subcommittee on Strategic Forces and Nuclear Deterrence meets this morning for its 14th scheduled hearing. This morning we will review ASAT capabilities in two separate panels.

In our first panel, General Piotrowski, the new Commander-in-Chief of the U.S. Space Command, will briefly review the military need for an ASAT capability. Following General Piotrowski's remarks, Brig. Gen. Robert Rankine, director of Space Systems and C^3 in the Air Force, will brief us on the current status and future plans for the miniature homing vehicle, or MHV, program under development in the Air Force.

Our second panel will consist of Mr. John Hammond, who is the director of the directed energy work for the SDI Organization, accompanied by General Rankine. Mr. Hammond will describe the status of several of the systems under development in the SDI that

might well turn out to have significant ASAT capabilities in addition to their potential SDI roles.

I have asked for these two panels for some pretty obvious reasons. While this committee has been supportive of the U.S. ASAT program based upon the MHV for the last couple of years, the House has prevailed in continuing the moratorium on ASAT testing. I see little that would suggest that we are likely to be more successful this year.

I myself do not believe that weapons get better because they are not tested. Therefore, I do not really accept the Soviet ASAT as a big threat as some do. Therefore, I do not really accept the threat to be as impressive as some have indicated publicly and as some have indicated before this subcommittee.

But regardless of that issue, if we cannot test we do not have enough confidence to warrant moving into production on the MHV ASAT, plain and simple. Finally, both the Soviet military power book and our own SDI program are showing signs of progress on other kinds of ASAT capability.

For all of these reasons, I think we will have to take a very hard look at the Air Force's new MHV program this year. We are at the big money point, gentlemen, and we will have to spend some $2.5 billion more in order to get only [deleted] operational ASAT missiles.

And given the budget constraints that we are being placed under this year because essentially of Gramm-Rudman-Hollings and a public perception that we should do something about this deficit, which essentially I agree with, it may be time to cut bait and use some of the funds to accelerate some of the SDI capabilities for use as ASATs.

Unfortunately, as the timing would have it, we have two rollcall votes scheduled to begin at 10:30 on the floor of the Senate. Those will be back to back votes. I am not sure we can get all the testimony in by that time, but let us try if we can.

I would simply say that, without objection, I would ask at this time that all of the fully-prepared statements of the witnesses be accepted as part of the record, because I know they will be examined very carefully by the members of the committee.

And with that, I will ask Senator Wilson if he has any opening comments and then we will get started with the testimony.

Senator WILSON. Thank you, Mr. Chairman.

My only opening comment is to express not only welcome to our witnesses this morning, but to reaffirm the significance of your comments. I think the ASAT capability is of enormous importance.

Prior to coming here a couple of days ago to this hearing, I contacted Admiral Baggett and Admiral Hayes and asked them to express to me in their own words the importance they attach to our having an ASAT capability. And both stated emphatically that they thought it was essential; not that they could not perform their mission without it, but it did not—that the absence of that capability would not allow them to do so nearly so well.

And they particularly indicated that, since the other side has it, they thought that the importance from a deterrent point of view could not be overemphasized.

I am very eager to have this testimony.

Senator EXON. Gentlemen, please proceed with your presentation. We are glad to have you this morning.

STATEMENT OF GEN. JOHN L. PIOTROWSKI, COMMANDER-IN-CHIEF, U.S. SPACE COMMAND AND NORTH AMERICAN AEROSPACE DEFENSE COMMAND

General PIOTROWSKI. Mr. Chairman, Senator, it is certainly a pleasure for me to appear before you and express my views and offer my opinion as Commander of the United States Space Command. And I will, as you have suggested, Mr. Chairman, keep my remarks brief and submit a statement.

I would like to start out by reminding, as you know, that there are several missions that the Space Command is chartered to execute. One of them is space control, which is analogous to sea control. Basically, it means knowing what is in space, keeping track of it, maintaining control of our own resources, and being able to protect, as we do on the sea, those resources from threats where necessary.

And Space Command also has the responsibility of space support, which means providing the necessary support those spacecraft require and to providing the services that the users of those spacecraft need, whether it be the U.S. Navy, the U.S. Army, services, government agencies, and the like.

And last, force enhancement.

I would like to speak to the affect that ASAT, specifically the Soviets', has on my ability to do the job and the need I see for the United States to have an antisatellite capability. First let me mention the threat to the forces and the threat I am sure Admiral Hayes and Admiral Baggett were speaking of as warfighting CINCs. They consist of principally the EORSAT or the Electronic Ocean Reconnaissance Satellite, the RORSAT, the Radar Ocean Reconnaissance Satellite, and the [deleted] as it is called.

The Soviets have constellations of those satellites, depending on any given day, numbering from [deleted] and intelligence sources have convinced me that they have the capability to surge as much as another [deleted] satellites in a contingency. So the threat can vary from anywhere from [deleted] of those kinds of satellites.

The EORSAT and RORSAT fly [deleted] apart. They not only image the broad ocean areas and detect and locate our surface ships, but they [deleted] Soviet capital ships that have the ability to target over the horizon.

So if I can paint the picture for you, Mr. Chairman, here comes the first satellite. It detects our ships at sea. The second satellite comes over and refines that information. The first satellite has [deleted] that have received that information. They know the location of that target.

That location is refined, and they can have the over-the-horizon cruise missiles fired within [deleted] of the passing of the second satellite in the series.

So it gives them a tremendous over-the-horizon undetected capability.

On the other hand, we have far less satellites in our constellations that support our forces, [deleted] and the like. A number of

those satellites are threatened by the Soviet ASAT. The antisatellite capability they have is a very formidable, well-tested and operational system. In fact, it was demonstrated as operational in [deleted].

It has been suggested that the Soviets have not tested that system since [deleted]. However, I would offer information that I have available from the intelligence community that they have fired the [deleted] booster which carries that antisatellite, that [deleted] antisatellite, into space, [deleted] and gives them an opportunity to test their forces, test their equipment, and test the response of that satellite. [Deleted.]

So they, in fact, have an operational capability. They continue to exercise the booster, they continue to exercise the command and control. I must tell you, Mr. Chairman, I am convinced that they have a good operational capability that has demonstrated a probability of kill [deleted].

As Commander-in-Chief of the U.S. Space Command, I also have the responsibility for force enhancement. By that we mean the ability to provide [deleted] that would allow Admiral Baggett, Admiral Hayes, CINCEUR, General Rogers, to use this [deleted] to their advantage in employing forces.

The Soviet ASAT has the capability to take out some of our [deleted] systems and deny us that [deleted]. There is an asymmetry in space. The Soviets have at any given time 150, plus or minus five to eight, satellites in space. We have a much smaller number.

They have the capability to deny us the use of some of our satellites. We on the other hand do not have the capability to, in any way, threaten their satellites. I believe this asymmetry, is inimical to our national interests and perhaps, on another plane, would even encourage them, because we cannot respond to the use of their antisatellite capability.

We would be left with absorbing the blow, accepting the loss, or some other horizontal or vertical escalation, we could not respond appropriately.

I urge you, Mr. Chairman and members of the committee, to support the full development and deployment of the U.S. antisatellite capability. I have spoken only of one of their capabilities, and that is their [deleted] antisatellite system.

They also have, of course, in development a laser system at Sary Shagan. And they can use their Galosh ABM systems that surround Moscow as satellite killers. So I believe they have a very robust, very formidable antisatellite capability.

I again, sir, would urge you and the committee to support the full development and deployment of our miniature homing vehicle antisatellite capability.

Sir, I would be pleased to answer any questions. But I believe it would be useful if those followed General Rankine's presentation.

[The prepared statement of General Piotrowski follows:]

PREPARED STATEMENT OF GEN. JOHN L. PIOTROWSKI, COMMANDER-IN-CHIEF, UNITED STATES SPACE COMMAND AND NORTH AMERICAN AEROSPACE DEFENSE COMMAND

ASAT

Mr. Chairman and members of the committee, I very much appreciate the opportunity to appear before you today to share with you, as the Commander-in-Chief United States Space Command, my views on the urgent need for acquiring a U.S. antisatellite capability. Over the years, the Congress, has, to its great credit, solicited the views of many witnesses on both sides of this very complex issue. You have heard from those who assert that space is, and must remain, a pristine environment unspoiled by the presence of military systems. You have also heard from those who assert that space is the "military high ground"—a regime in which the United States must assert itself if we are to guarantee our national survival. On the first point, space is being used for military purposes and its use has been on the increase since first exploited by Germany's V-2 SRBM. On the second point, space is a regime in which some military operations can, and are conducted more efficiently than by terrestrial systems or land-based forces. But, we don't as some seem to suggest, put things in space as a result of the Everest Principle, "Because it's there." We place systems in space when the Nation's security demands it—when it makes clear, compelling sense to do so! Today, we and the Soviets both depend heavily on space systems for such key national security functions as communications, navigation, environmental monitoring, and most importantly missile launch detection.

While both nations have capitalized on space to support and enhance the effectiveness of land, sea, and air forces, I believe that the Soviets clearly intend to exploit space to the maximum extent their capabilities will allow. Those capabilities are real, they are formidable, and they are constantly growing and improving. Soviet ASAT capability is not limited to their operational co-orbital interceptor, but also includes ground-based lasers and ABM interceptors deployed in the Moscow area—a TRIAD of diverse and complementary antisatellite systems. These are not theoretical capabilities built on crude technology. They represent "real" military capability: it exists, it has been fully developed, fully tested, and fully demonstrated as an operational system as early as 1982. It is without question, fully integrated into their military plans and operations, and it is in the hands of an adversary who has earned the reputation for employing naked force to achieve their national objectives. Hence, it is my very real concern that in a crisis or conflict, the Soviets not only could, but would definitely attempt to seize the initiative in space.

The effectiveness, or state of their ASAT should not be the issue here. The facts in this regard are clear. Given this operational Soviet ASAT capability, the need for a U.S. capability is important at two levels. First, to deter the Soviets from using what would be a unilateral capability . . . in that sense the absence of a U.S. antisatellite capability could well cause deterrence to fail . . . and "actually" encourage the Soviets to take the offensive. And second, should, in spite of our best efforts, that deterrence fail, provide us the capability to selectively destroy Soviet military satellites that they need to conduct their operations.

A Soviet first use of their ASAT in the absence of a similar U.S. capability leaves the United States in a situation where we must absorb the blow and suffer the loss, without responding in kind, or escalate the level of violence.

As you know, USCINCSPACE is assigned the mission of space control. Space control, not unlike sea control for maritime operations, hinges on a nation's right to safe passage. It includes operations that ensure access to space for United States and Allied forces; and, when appropriately directed by national authority, entails denying an adversary the use of those space systems which support hostile forces. Today, the Soviets have the capability to vigorously conduct space control operations. I cannot make the same claim for the United States.

The U.S. ASAT program is designed to redress this asymmetry. It is focused explicitly on those Soviet satellites which threaten U.S. and Allied terrestrial interests in time of war. We must step up to the threat and provide for our legitimate security interests in space; just as we do on land, at sea, and in the air. Continuing to rely on Soviet "goodwill" might appear prudent to some, but as a nation we do not, and must not, assume Soviet goodwill anywhere—much less in space.

It is a distortion of the situation that actually exists, to characterize the Soviet's ASAT testing hiatus as an indicator of Soviet "restraint." The Soviets have, right now, a fully operational satellite interceptor. Its booster continues to be launched on a routine basis. The interceptor itself has long passed the milestone of full operational capability and the Soviets have demonstrated their expertise in precision spacecraft maneuvering in their SOYUZ and MIR programs. Clearly, this is not "re-

straint"; it is nothing more than the Soviet's admission that their operational satellite interceptor has such high reliability that further testing is no longer essential.

Given our growing and already significant dependence on space systems, along with the Soviets expanding ASAT capabilities and record of unconstrained use of force. I am absolutely convinced that we need to resume testing and commence deployment of the F-15 air-launched ASAT.

Senator EXON. Thank you, General Piotrowski.

Before I call on General Rankine, I will call on the distinguished ranking member of our subcommittee, my colleague from South Carolina, Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

Mr. Chairman, I want to congratulate you on holding this important hearing. I would not want anyone to interpret our starting time this morning as a lack of interest in the ASAT program. Rather, it will afford the time we need to develop the record necessary to get this critical program back on track.

Mr. Chairman, I know you have been a strong supporter of the ASAT program since the beginning, as have I and most of the members of this committee. Unfortunately, our colleagues on the House side have not agreed with us. Because the ASAT program has been considered in recent years in the context of last minute continuing resolutions and grand arms control compromises, the program has not been considered fully on its merits.

As a consequence, the program has suffered a costly and wasteful 2 year moratorium on the testing program, which goes contrary to every initiative the Congress has taken to improve DOD weapons system acquisition.

The testimony this subcommittee has received in past years has been very convincing with respect to the Soviet ASAT threat. While critics point to the limitations of the existing Soviet ASAT system, they cannot ignore the fact that this program is operational today, requires no further testing, and threatens critical U.S. space assets with the same degree of effectiveness that we hope to achieve with our own Miniature Homing Vehicle (MHV) ASAT program.

Mr. Chairman, the record is not as complete as I believe it should be with regard to the warfighting potential of Soviet space assets. I had hoped that the subcommittee would have had the opportunity this morning to hear from Dr. Larry Gershwin to brief us on developments in Soviet space-based warfighting assets. Unfortunately, the press of subcommittee business could not permit that.

I would hope that the witnesses here today, and especially General Piotrowski, would be able to address how the Soviets rely increasingly on space-based systems to enhance the effectiveness of their terrestrial forces. This has been the case for some time in the maritime arena. I understand that it is increasingly the case in the conventional warfare arena, where space-based assets have the potential to leverage their already numerically superior Warsaw Pact forces.

Mr. Chairman, if this is true, it would seem to counter the conventional wisdom of those who argue that the United States is more dependent on space than the Soviets. It should also be of considerable concern to all of us who do not wish to see the effectiveness of our conventional force improvements diminished by space-

based assets that can direct fire against even our long-range stand-off weapons.

Mr. Chairman, I too welcome our witnesses this morning. And I believe this is General Piotrowski's first appearance before this subcommittee, and I take this opportunity to congratulate him on his new assignment.

General Rankine, I welcome you back and look forward to your testimony on the status of the program. In this period of budget constraints, it is critical that you make a strong case for the health of the technical program.

Finally, Mr. Chairman, I welcome Mr. Hammond, who will be joining us on the second panel to discuss those aspects of the SDI program that bear on the ASAT mission. Mr. Chairman, I think we need to follow the cost and schedule details of this discussion carefully.

The ASAT mission is too important today to let the possibility of the "better becoming the enemy of the good." I believe that the ASAT course we are on now provides the earliest possible availability of the needed capability at the least cost. We need to stay that course and get on with testing, so that this critical deficiency in our overall defense posture can be fixed.

Thank you, Mr. Chairman.

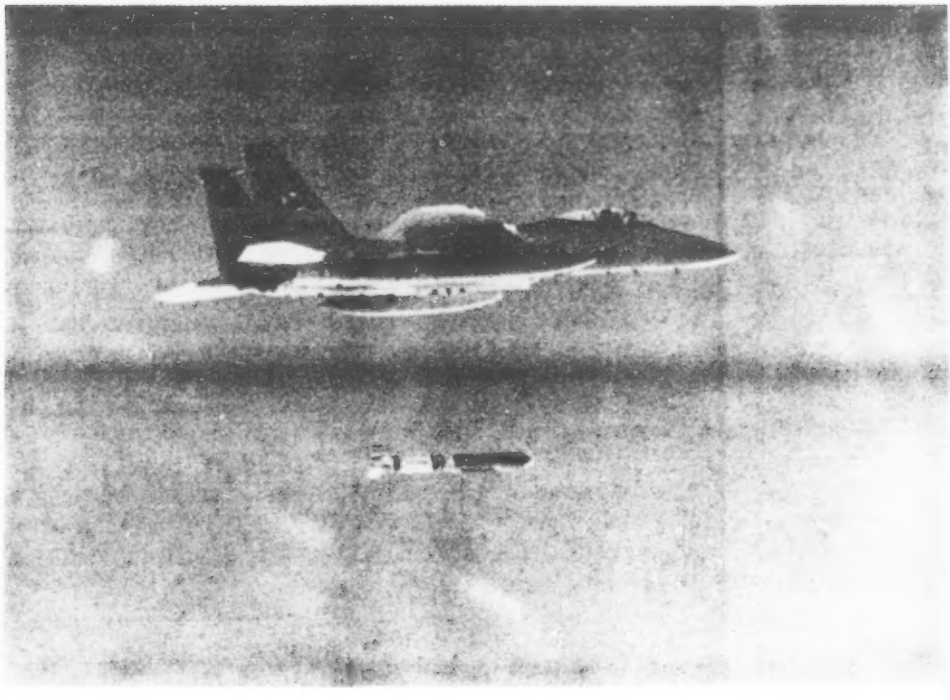
Senator EXON. Thank you, Senator Thurmond.

General Rankine, we would be pleased to hear your testimony.

STATEMENT OF BRIG. GEN. R.R. RANKINE, JR., U.S. AIR FORCE, DIRECTOR OF SPACE SYSTEMS AND COMMAND, CONTROL, AND COMMUNICATIONS, HEADQUARTERS USAF

General RANKINE. Thank you, Mr. Chairman. I appreciate the opportunity to testify before this committee today.

I have some charts to illustrate some of the points that General Piotrowski and Senator Thurmond have raised, and so I think they might help the committee reach a better understanding of our situation.



This of course is a picture of the F–15 launching the air-launched miniature vehicle ASAT.

OUTLINE

Why?
    Deterrence.
    Stability.
What?
    System description.
    Program progress to date.
    Status of issues.
How?
    Reassessment.
    Restructure.

The points I would like to cover this morning are sort of a simple why, what, and how. That is, why do we need an ASAT, just exactly what is the U.S. ASAT, and how does it operate, and then specifically, how do we plan to execute the ASAT program, given the moratorium that has been invoked upon the Department of Defense by the Congress for the past 2 years?

WHY DO WE NEED AN ASAT?

Deter use of Soviet ASAT Systems.
Negate Soviet Assets.
    Targeting information.
    Force multiplier.
Control escalation [response in kind].
Support negotiations.

Now, General Piotrowski has already spoken to the issue of why we need an ASAT to deter the Soviet use of their ASAT, to negate

the use of Soviet satellites which provide support to their terrestrial forces, and give them a significant advantage to control escalation and to support negotiations.

And I will go through each of these areas with a specific example.

SOVIET ASAT CAPABILITIES

Coorbital system.
    Launched from ground.
    One or two revolution intercept.
    Conventional explosion prior to intercept produces fragments which collide with target.
[Deleted].
    Included in Soviet strategic command and control exercises.
Ground based lasers.
    Sary Shagan.
[Deleted].
Antiballistic missile system around Moscow.
    Direct ascent intercept.
    Nuclear warhead.

The Soviets have a coorbital ASAT system, as we refer to it. What that means is that the Soviet ASAT is launched from the ground, and within one or two revolutions it achieves the same orbit as the satellite which it is attempting to attack. At that point, then a conventional explosion prior to the intercept produces fragments which impact the target. In fact, I have a picture here to illustrate that point.

This is an artist's concept of the Soviet ASAT. And right prior to impact, the ASAT explodes, and you can see the fragments that go

out into space, and those fragments then would impact the target that is in the same orbit on a collision path.

I will go back to the chart for a moment. The Soviets have tested this ASAT against objects in space [deleted] and which the Soviets have indicated to us is operational, as I will explain in a few moments.

That [deleted] ASAT was successful in [deleted] to get a probability of kill of approximately [deleted]. We are attempting to achieve approximately [deleted].

The only difference is they have demonstrated that capability and we have not.

The Soviets have included the ASAT in their command and control exercises. In fact, the last test that they conducted in 1982 was in conjunction with a major command post exercise. And I will say more about that in a minute, but I think it is significant to note that [deleted].

Now, our JCS does not exercise weapons which are not available to them and neither, I propose, does the Soviet Union. The Soviet Union, [deleted].

As General Piotrowski pointed out, the Soviets also have lasers at Sary Shagan [deleted] which we believe, and intelligence estimates support, have ASAT capability.

Furthermore, the ABM system deployed around Moscow gives the Soviets a nuclear ASAT capability. [Deleted.]

They have [deleted].

[Chart deleted.]

Let me just say a few words about that demonstration that was conducted in June 1982 in conjunction with the last or the most recent test of their ASAT against an object in space. [Deleted.]

[Chart deleted.]

Now, let me turn to the matter of the use of the Soviet satellites to support their terrestrial capabilities, as Senator Thurmond referred to. This chart breaks the Soviet satellites up into three categories, categories which we feel from a military standpoint represent the [deleted] of those satellites are those in the first block here: the EORSAT, the RORSAT, [deleted]. Those satellites provide [deleted] support to the forces, terrestrial forces, in tactical engagements and theater engagements, whether on the seas or on the land.

And our F–15 air-launched miniature vehicle ASAT is specifically directed at having a capability to deny the use of those satellites which give the Soviets an advantage in tactical confrontations.

Now, as we look toward the future, the Soviets have another group of satellites shown here under the phase two that give them the capability to support their terrestrial forces in other ways. Some of those satellites are at higher altitudes than our current F–15 air-launched miniature vehicle ASAT, and as a result of that we have an improvement program that we are going to propose to you to increase the altitude capability of our air-launched miniature vehicle ASAT.

Those targets are a [deleted] and we hope to be able to encompass those targets by the early to mid-nineties.

And finally, in phase three we have the Soviet satellites which they use for force execution, their communication satellites and so forth that they are at very high orbits. [Deleted.]

[Chart deleted.]

Now let me give you an example to illustrate the case General Piotrowski raised a minute ago, to show you that the Soviets do in fact use the RORSAT and the EORSAT in the manner which he described. [Deleted.]

Senator THURMOND. What was done with the information? I did not hear you.

General RANKINE. [Deleted.]

[Chart deleted.]

General RANKINE. So I think that it is clear that the Soviets have demonstrated an intention to use——

Senator WILSON. Mr. Chairman, could I interrupt for just a second?

Senator EXON. Sure.

Senator WILSON. [Deleted.]

General RANKINE. Sir, I cannot address that specifically, probably not at this security level, nor am I the expert on that.

General PIOTROWSKI. May I respond, Senator Wilson? If I could just say in answering your question, the Soviets clearly had the capability to target based on that information. [Deleted]. But the quality of the location, in use with the weapons that they have to employ from over the horizon, that is clearly of a quality to provide the targeting information they need to in fact target and attack.

Senator WILSON. Thank you, General.

General RANKINE. So Mr. Chairman, I have given you two examples: one where the Soviets have clearly demonstrated their intention to use their ASAT in a strategic confrontation and their intention to use their satellites, imaging and RORSAT and the EORSAT satellites, in a tactical confrontation.

Another important point to make is the control of escalation, which I think is an important aspect from the standpoint of response in kind. Our JCS have conducted our own command post exercises recently and of course have included the Soviet ASAT, since we consider that that ASAT is indeed operational.

In those exercises, when the Soviet ASAT is assumed to have been used it leaves the JCS in a terrible dilemma, as General Piotrowski says. We either do nothing or else we have to identify a response which is not exactly a response in kind. It is hoped that that response is viewed by the Soviets as a response that is not escalatory, but of course we can never be sure of Soviet interpretations of our responses.

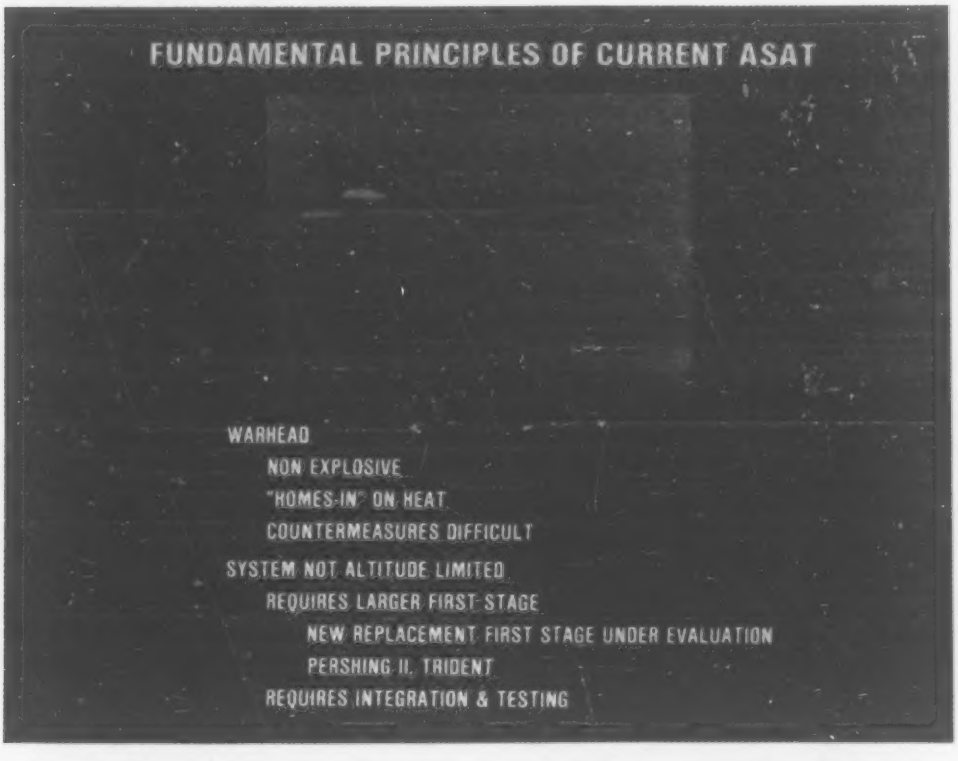
And so we do not have the assurance that our response will not cause an escalation of the conflict. Therefore, without the ASAT we do not have the capability to control the escalation of a conflict in the way that we should be able to control that escalation.

And finally, the last point I would like to make with respect to the need for the ASAT is the matter of arms control. I think that you all agree that in order to negotiate with another party you have to have something to negotiate with, and at the present time the Soviets have an operational ASAT, we have none, and they

have kept us in that position through moratoriums on the testing which were necessary to get that system into operation.

And so I do not believe that the Soviets will be willing to come to the table or need to come to the table to negotiate a final agreement with us if they have already succeeded in denying us an ASAT capability. And we feel it is very critical for us to continue the testing, even if our intention was ultimately to try to negotiate a verifiable arms control agreement with the Soviets with respect to ASAT.

Next let me go to the matter of just what exactly is the U.S. ASAT.



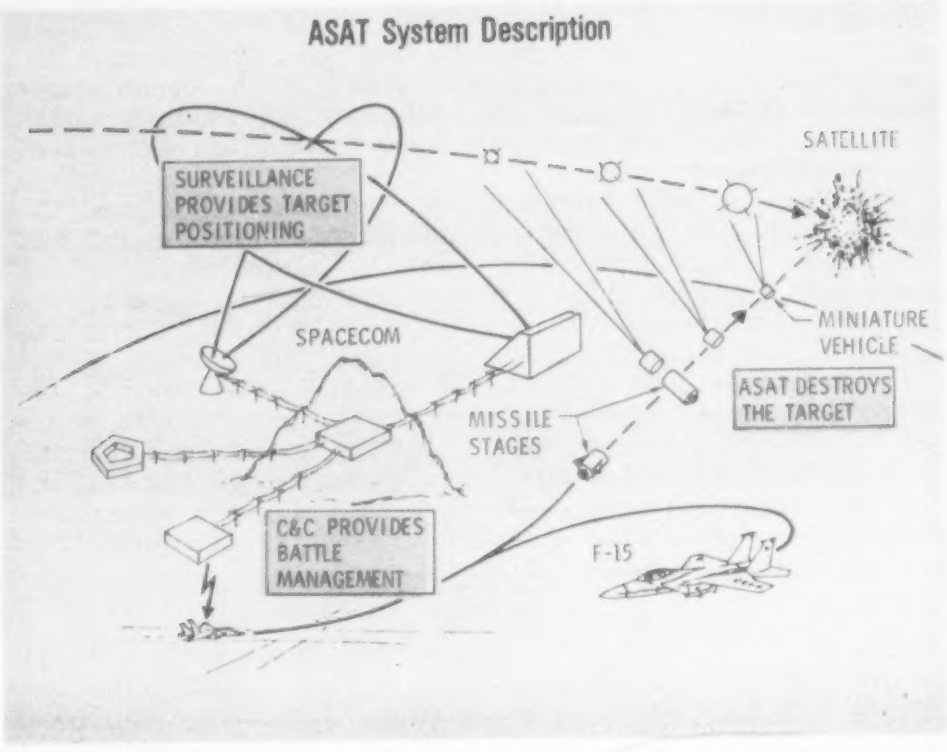
I think many of you are familiar with this, but let me just refresh your memory now.

First of all, our ASAT is launched from an F–15 aircraft. It is nonexplosive. It homes in on the heat of the target satellite and simply collides with that satellite. It is difficult to countermeasure.

Technically, the system is not altitude limited. The only thing that limits the altitude is the energy of the boosters that you put under it. To increase the altitude, the effective altitude, would require a larger first stage, and we are currently evaluating two approaches, either an enhanced, more energetic lower stage for the air-launched version or the possible use of a ground-launched booster, an available ground-launched booster such as the Pershing II.

In any case, altitude enhancements will require integration and testing. But since the miniature vehicle and the upper stage would be the same, early availability of enhanced altitude capability re-

quire that the F-15 launches continue as soon as possible against objects in space.



The operation of the system is depicted on this chart. Satellite ephemeris information, satellite track information, is provided by our worldwide sensors to General Piotrowski's facilities in Colorado Springs. There we compute the necessary trajectory for the F-15 to fly, and that information is transmitted to the F-15 base, where it is loaded on the computer on the F-15.

The F-15 is scrambled and flies to a point in the sky where it releases the ASAT on a collision trajectory with the satellite.

PROGRAM HISTORY

February 1980—Prototype development initiated.

August 1985—Major independent program reassessment added production verification (PV).

December 1985—Congress cut FY86 PB request. Deleted all production funding ($97.7M). Deleted all Milcon funding ($14.9M).

Congress prohibited testing against space objects.

October 1986—Congress cut FY87 PB request. Reduced RDT&E funding by $78M (28%). Deleted all production funding ($28.5M). Deleted all Milcon funding ($15.6M).

Congress again prohibited testing against space objects and denied implementation of PV.

October 1986—President called for another major reassessment.

December 1986—SECDEF advised President there was no other effective capability available as early as F-15 air-launched MV.

Let me recap for you a few of the events that have occurred in the life of this program. The prototype development was initiated in February 1980. The Air Force went through, in August 1985, a

major independent program reassessment and we determined that a program which we call production verification was needed in order to enhance the producibility and the maintainability of the weapons system.

That was added to our program for fiscal year 1986. However, in December 1985 Congress cut the fiscal year 1986 President's budget request for those funds and deleted all production funding, deleted all MilCon funding, and imposed the first moratorium against testing against space objects.

Again, in the 1987 President's budget Congress reduced the RDT&E funding by 28 percent, deleted all production funding, and deleted all of the MilCon funding. They prohibited testing against objects in space and denied the implementation even of the production verification money in order to improve the producibility of the weapon.

In view of this, in October 1986 President Reagan called for another major reassessment of the program. In December 1986, Secretary Weinberger provided the information to the President and told him that there was no other effective capability other than the F-15 miniature vehicle ASAT that could be had, could be available in the early timeframe in order to redress the gross inequity that we have vis a vis the Soviet Union.

ASAT TESTS

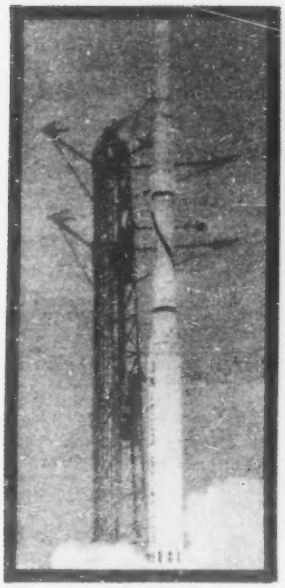
[Deleted.]
POINT-IN-SPACE, 21 Jan 1984.
Infrared probe #1, 13 Nov 1984.
First intercept, 13 Sep 1985.
Infrared probe #2, 22 Aug 1986.
Infrared probe #3, 30 Sep 1986.

The tests of the U.S. ASAT that have been conducted to date are illustrated on this chart, shown as a function of altitude. We have had five tests. All of them have been at least partially successful, four of them completely successful.

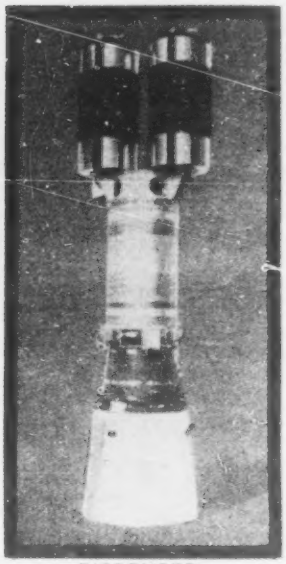
The only intercept against an object in space occurred before the imposition of the first moratorium, and that was on 13 September 1985, and that was a complete success. The most recent test was conducted in September 1986, and that was—completely complied with the congressional law and was against the heat emitting from a star. But it demonstrated the capability of the sensor to look close to the edge of the Earth and still see the target.

[redacted]

(U) INSTRUMENTED TEST VEHICLE SYSTEM



SCOUT



DISPENSER

WEIGHT
DIAMETER
SIGNATURE [ ]
ORBITS

INSTRUMENTED TEST VEHICLE

[redacted]

The target that we propose to use for a future test of the U.S. ASAT is called the instrumented test vehicle, the ITV. It is a Kevlar balloon, in simplest terms, which we are able to heat up to represent various signatures of potential targets. And it also allows us to measure the miss distance that the U.S. ASAT achieves. That is a very important parameter for us to know in order for us to determine the true capabilities of our ASAT.

INSTRUMENTED TEST VEHICLES

(TARGET SATELLITES)

Launched on 12 Dec 1985.
Planned to use as target in early 1986.
[Deleted.]
  Battery limited.
  Minimize number and duration of contacts with ground.
One ITV activated on 17 Dec 1986.
  Plan was to use as first FY 1987 target.
  Identify potential problems prior to subsequent launches.
  Performance to date exceptional.
    Inflated properly.
    50, 60, 80, and 100 percent infrared signatures, demonstrated.

The instrumented test vehicles, two of them, a pair of them were launched on the 12th of December 1985. We had planned to use them as targets in early 1986, but shortly thereafter Congress imposed the moratorium which prevented us from testing against those two targets.

Their expected life was only [deleted] but by reducing the number of times that we communicate with the satellites and letting them drift a little bit we have prolonged their life to [deleted]. We have tried to extend them to a period of time when we could make them useful.

We activated one of the instrumented test vehicles on the 17th of December 1986 because we felt it was important to verify that the instrumented test vehicle itself worked satisfactorily since we had another moratorium. We felt that it was important to correct any deficiencies there may have been prior to the time we could begin testing again.

However, the performance of the ITV was exceptional. It inflated properly and it successfully demonstrated 50, 60, 80, and 100 percent infrared signatures, as it was supposed to do.

WHY MUST WE TEST AGAINST OBJECTS IN SPACE?

Necessary to prove that system is ready for production.
Must be certain we won't be producing a "flawed" weapon which will require expensive modifications after it is fielded.
Production missiles incorporate "lessons learned" from tests.
Necessary to prove that system works.
Across range of operational altitudes and intercept geometries.
"Operational" implies that we have confidence that it works.
"Deterrence" implies that the Soviets have confidence that it works.
No interceptor or laser ASAT can proceed to production or operation without testing against objects in space.

So why must we test against objects in space, then? First of all, we believe it is necessary to do that just to prove that the system is ready for production. We cannot be certain that we are not fielding a flawed weapons system unless we have adequately tested it. In every other realm, this Congress demands adequate testing before we are allowed to go into production.

Second, it is necessary to prove that the system works. And I think this is perhaps the most important reason. We have to demonstrate that across a wide range of potential operational conditions that we can, in fact, intercept the satellite target.

"Operational" implies that General Piotrowski has the confidence that it works, and he needs to test in order to have that confidence. On the other side, "deterrence" implies that the Soviets have the confidence that it works. We cannot deter the use of the Soviet system unless we have demonstrated to the Soviets that our system works.

Finally, I think it is important to point out, since the idea has come across that maybe there is a better technology and something should come along that could be used later, it does not matter whether we test now or whether we test later. The important thing is we have got to test. We want to test now because we want to have an ASAT to redress the imbalance.

Senator EXON. Excuse me, General. I am sorry. Would you back up a little bit?

I was listening carefully, but my train of thought was interrupted. Would you please back up a little bit, because you were able to say something very important, and I wanted to hear it.

General RANKINE. Yes, sir. I was about to address the matter of the need to test.

Whether we proceed with this air-launched miniature vehicle ASAT or with some other interceptor system, or even some laser system, it is absolutely essential that we be able to test that system against an object in space. And so if this Congress would choose further delays in hopes of a better system to come along, this Congress is only delaying the inevitable, which means we must test against objects in space.

The only thing we could have some confidence in without testing against an object in space is a nuclear system. A nuclear system, all we have to demonstrate is that we can get to a point in space within some reasonable, very large range of the satellite, and we know we would have killed it. We do not have to do a nuclear test.

We can launch an ASAT up into the orbit. We can launch the missile into the orbit of the satellite and do a point-in-space test, and we can have a high degree of confidence that that nuclear warhead would kill the satellite. That is why we give an ASAT capability to the Soviet ABM system, the Galosh.

On the other hand, if you have a hit-to-kill system, where you actually have to collide with the satellite, the usefulness of that system depends entirely on what we call the end game. The ability to crash into the target is critical, that the sensor works up to the last few seconds of flight and actually causes the crash to occur.

With a ground-based laser, it is essential that we can point accurately enough to put the beam on the target and that we can clean the beam up as it goes through the atmosphere.

So in either case, we would have to test against an object in space to prove to the Soviets that we have the capability and to prove to the user, CINC of U.S. Space Command, that he has an operational system.

HOW?

Let me turn finally to how we propose to execute the program, given the restructuring that the President has directed.

[Chart deleted.]

The reassessment that we have accomplished looked at all available ASAT systems that are planned for the future. That is, those systems which might have some inherent ASAT capability and might be adapted for ASAT. I have ranked all of the systems that we looked at on this chart in descending order, where the order is that in which we felt that the system could be available to start providing some operational utility.

And so they are in sequence of how early they could be made available. I think you see at the top of the list that the air-launched miniature vehicle is still the earliest we believe that we can have an operational capability, with that system as early as [deleted].

Now, in the right hand column I show the target capability. That refers to the target set that I showed you on an earlier chart. And the category one, remember, was the capability to get up to about [deleted].

So that kind of gives you an idea of the capability.

The next two on the chart, the medium-altitude booster with the same upper stage, ALTAIR, and MV, and the air-launched minia-

ture vehicle with a new lower stage, those are two ways in which we perceive that we can increase the altitude capability of the same air-launched miniature vehicle ASAT interceptor. And we are studying those two alternatives at the present time, and the President's budget for fiscal year 1988 allows for the funding of one of those approaches.

The next item is a ground-based gas laser. The Air Force has been interested in the use of a laser as an antisatellite for some time, and in fact up until 1984 was engaged with DARPA in the research on the use of an excimer laser as ground-based laser ASAT.

With the creation of the Strategic Defense Initiative in the President's 1985 budget, all of the laser programs went under the control of the Strategic Defense Initiative, and General Abrahamson began to pursue that same technology, primarily for ballistic missile defense applications. The Air Force has continued to follow that work and we believe that we can take advantage of the SDI's investment in that laser technology up to this point and leverage it to use it for this tactical application of U.S. antisatellite.

And so we propose to add some funds to General Abrahamson's investment in the laser to address those specific areas which are necessary for an early ASAT application, and by doing that we believe that such a capability could begin to come to fruition in the [deleted].

When we get to the higher altitude capabilities and to the other SDI systems, what we find is that there is considerable development work left to do and that most of those come into the [deleted]. We will go into that a little bit more when Dr. Hammond joins the second panel.

But for example, the ERIS, the exo-atmospheric reentry intercept system, would have some inherent ASAT capability, but it would have to have design changes to make it able to accomplish that particular mission. Those design changes would require RDT&E funds, and of course the testing against objects in space that I referred to earlier would require the investment of RDT&E funds.

And so it does not come free. You have to invest, and our belief is that the [deleted] that you would lose without any U.S. ASAT, to wait for that would be—that capability, would be very detrimental to the U.S. posture, given that the Soviets have this unilateral advantage with an ASAT at this time.

[Chart deleted.]

I brought up the issue of the laser and a very important point I would like to make is that the Air Force does not see the ground-based laser as a substitute for an interceptor, but rather as a companion to an interceptor. A ground-based laser and an interceptor in the future would provide the user, General Piotrowski, with a weapons mix in order to have a higher degree of assurance that he could provide the space control that he has been directed to provide.

The interceptor provides a very timely response, in that it can fly to the orbital track of the satellite, and it is more survivable because of its inherent mobility. On the other hand, the ground-based laser is essentially inexhaustible. You do not have to buy

bullets for it, like you have to buy for the air-launched miniature vehicles, and the bullets go out at the speed of light.

This complicates the Soviets' targeting problem—or, excuse me, the Soviets' survivability problem for those systems that they are using to threaten our forces, because they cannot harden sufficiently against an intercepter and they cannot sufficiently maneuver out of the way of ground-based laser.

And the combination of the two gives the user, the CINC of U.S. Space Command, greater latitude in exerting the space control that he must exert in times of crisis. This chart shows how a miniature vehicle like our current air-launched miniature vehicle ASAT capability and a ground-based laser with it would have those lethality characteristics as shown on this chart, how the two in combination would allow us to negate a larger number of Soviet satellites over a shorter period of time.

And we have an analysis like this going on in considerably more detail at the present time in the Air Force Center for Studies and Analysis in order to better identify what the force structure should be for a future mix of weapons systems to provide space control for the United States.

FISCAL YEAR 1987 PROGRAM

Fully intend to comply with public law.
No testing against objects in space.
Production verification terminated.
No live fire missile tests planned.
Test team temporarily reduced.
Use money to start laser and improved altitude efforts.
Will reactivate for intercept tests in FY 1988.
One of target satellites activated.
Performance outstanding.
Will continue to fix problems identified earlier on air-launched system.

Finally, to get to the specifics of the program—yes, Senator Wilson.

Senator WILSON. Could you go back to that slide for a minute.

I do not quite follow the one on the right-hand side, the one that says MVs alone and MVs plus the ground-based laser.

General RANKINE. The point is that if we have the air-launched miniature vehicle ASAT alone and we were limited in the number of rounds we could fire and we only have two bases, then this is the rate at which we can intercept Soviet targets.

If you augment that with two ground-based laser sites, you would have this type of a characteristic. The two systems work together then. And of course, since you have essentially an inexhaustible capability, although you have to wait for the track to come over the ground-based site, nevertheless you do not run out of bullets.

Here you only have the number that you buy, and the Soviets can keep reinforcing, keep surging and surge launching. So it gives you sort of an inexhaustible supply, yet you have the miniature vehicle to take care of the very timely targets that you might need to get, since the Soviets are able to start operating their RORSAT and EORSAT within the [deleted].

[Deleted] the Soviets can begin to operate that satellite. That is much different from the way we operate satellites. And so the F-15

miniature vehicle is very important, because of the timeliness with which it can get to those Soviet satellites.

On the other hand, there are some satellites which we do not care whether we get them sooner or later, as long as we get them within some period of time, say 24, 48 hours. For those applications, the ground-base laser is superb.

Senator WILSON. Thank you.

[Slide deleted.]

General RANKINE. Mr. Chairman, I have only three more charts and I will get to the specifics of the program.

Senator EXON. Excuse me. You have three more charts and then you will get to the specifics?

General RANKINE. No. These charts are the specifics of the program. Then I will be finished, Mr. Chairman.

Senator EXON. Thank you.

General RANKINE. The fiscal year 1987 program that we are now embarked upon we have modified in order to comply fully with the public law. We will do no test against objects in space, and we have terminated the production verification as Congress has required. We do not plan, in fact, any live fire tests in fiscal year 1987. The testing has been temporarily reduced in order to make funds available to start the laser and the improved altitude effort that I just described.

We will reactivate the testing for intercept tests which we hope to begin early in fiscal year 1988. As I pointed out, one of the target satellites has been activated and we have shown that the instrumented target vehicles work superbly.

FISCAL YEAR 1988/89 RESTRUCTURED PROGRAM

Program consists of:
- Continuing the air-launched program.
  - [Deleted.]
  - Production verification.
- Incorporating an improved altitude capability.
  - Trade-off between ground and air launched system.
  - [Deleted.]
  - Requires concurrent testing of MV and upper stage in basic program.
- Investing in laser technology.
  - Cooperative agreement with SDI.
  - Key ASAT-related component development.
- Testing against space objects is vital.
  - Oppose another testing restriction in FY 1988.
  - Seek to lift restriction in FY 1987.

For fiscal years 1988 and 1989, the program has been restructured as shown on this chart. It has three main elements.

First of all, we believe it is absolutely essential to continue the air-launched miniature vehicle program, and we have included in the fiscal year 1988 budget the long lead production for [deleted] missiles and production verification to more economically produce and support those [deleted] miniature vehicle assets.

The second item is that we are incorporating an improved altitude capability, doing a tradeoff between ground and air-launched systems, as I mentioned, and we seek to achieve the capability greater than [deleted] with that improvement. But getting it quickly depends upon concurrent testing of the miniature vehicle and the upper stages in the basic program.

Finally, the third part, we are investing in laser technology. We have a cooperative agreement to do that with the Strategic Defense Initiative Organization. And the key ASAT components that we are involved in are the excimer device, point-ahead compensation, and cooled adaptive optics, which all three are necessary for this particular application to ASAT.

We believe that testing against space objects is vital. Therefore, the administration opposes another testing restriction in fiscal year 1988, and we have in fact sought to lift the restriction in fiscal year 1987 in language which accompanied the DOD 1987 supplemental.

CONCLUSIONS

Urgently needed for stability and deterrence.
Program restructured.
No critical technical problems.
Intercept testing required.
Technology for future included.

In conclusion, Mr. Chairman, the ASAT is urgently needed for stability and deterrence. The program has been restructured to accommodate 2 years of inability to test against objects in space.

There are no technical problems, critical technical problems which are remaining. All those problems are behind us. However, we do require intercept testing in order to successfully complete the program. And we have also included technology for the future.

That concludes my remarks. Thank you very much.

Senator EXON. General, thank you very much. That was a very interesting presentation.

I am going to suggest, in view of the fact that we have at 10:30, two rollcall votes, and they are going to be back to back and I think we are going to be out for at least one-half hour plus, so we will try to finish by 10:30. I am going to suggest, in the interest of saving time, that since some of the questions that we would ask of this panel would be the same questions that we would ask the second panel, I am going to ask Mr. John Hammond to come forward at this time, if it is all right with the members of the committee, to make his presentation, because I believe our questions are going to apply to both panels.

Is there any objection to proceeding in that manner?

[No response.]

Senator Wilson, I am suggesting, since most of our questions will apply to both panels, that we hear from Mr. Hammond at this time, and then I think we could expedite the proceedings.

So please proceed, Mr. Hammond.

STATEMENT OF JOHN H. HAMMOND, DIRECTOR, DIRECTED ENERGY, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

Mr. HAMMOND. Senator Exon, members of the committee: I am pleased to be here this morning. I am the Director of the Directed Energy Office at the Strategic Defense Initiative Organization. I formerly was the Assistant Director of Kinetic Energy. I would also like to point out that Colonel Raymond Ross is sitting behind me. He is currently the Director of the Kinetic Energy Office at the Strategic Defense Initiative Organization.

I have submitted a fairly detailed statement for the record.

Senator EXON. Without objection, it will be accepted.

Mr. HAMMOND. At that point, I would like to begin by saying that during the formulation of the restructured ASAT program discussed earlier today by General Rankine, the considerations which I am about to outline have been discussed in detail and coordinated with the Air Force, and will continue to be coordinated.

ASAT RELATED SDI TECHNOLOGIES

Kinetic energy: ERIS, SBKKV (components).
Directed energy: free electron lasers, excimer lasers (with AF), adaptive optics, DF chemical lasers, other (space based lasers, particle beams).

In general, our conclusion is that several of the SDI technologies which I will discuss today, and are summarized on the slide behind me, are, with varying degrees of modification, promising for ASAT applications, but certainly on a time scale longer than that of the current aid-launched miniature homing vehicle system.

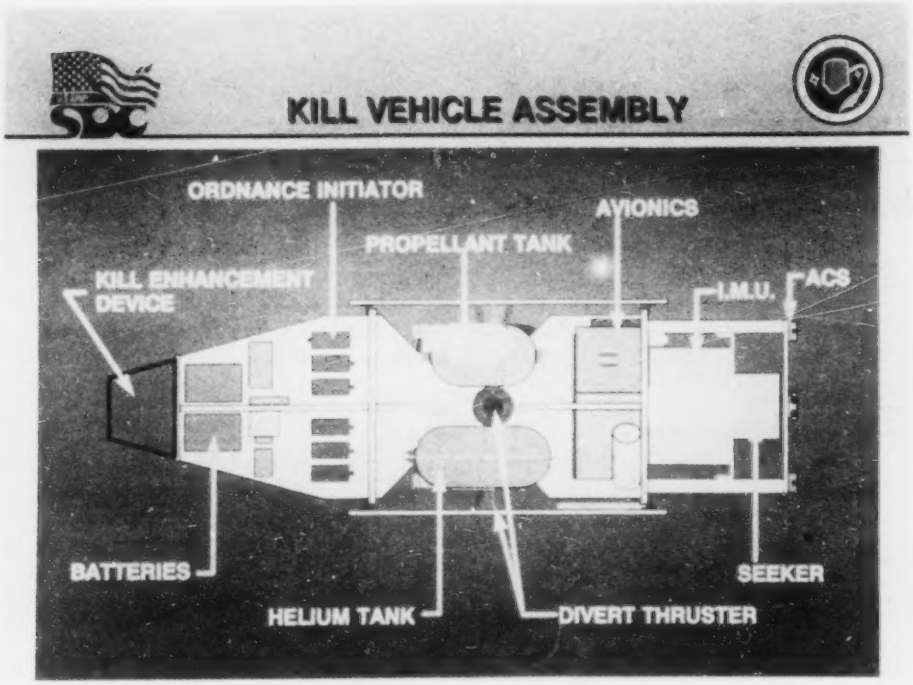
I will discuss, in turn, kinetic energy weapons—that is, the rocket interceptors, primarily the ERIS system. I will not discuss in any detail to speak of the space-based kinetic kill vehicle (SBKKV) components. Those are basically small space-based rocket technologies that are being developed under the program for ballistic missile defense.

I will then turn to directed energy and discuss free electron lasers, which have potential in the very long term for high altitude ASAT. It really is the growth potential option for ASAT.

I will also discuss excimer lasers, which we are currently funding jointly with the Air Force; adaptive optics technology; and chemical lasers. Finally, a few other potential candidates, such as space-based laser and space-based particle beam, will really not be discussed in any substantial detail because they are [deleted].

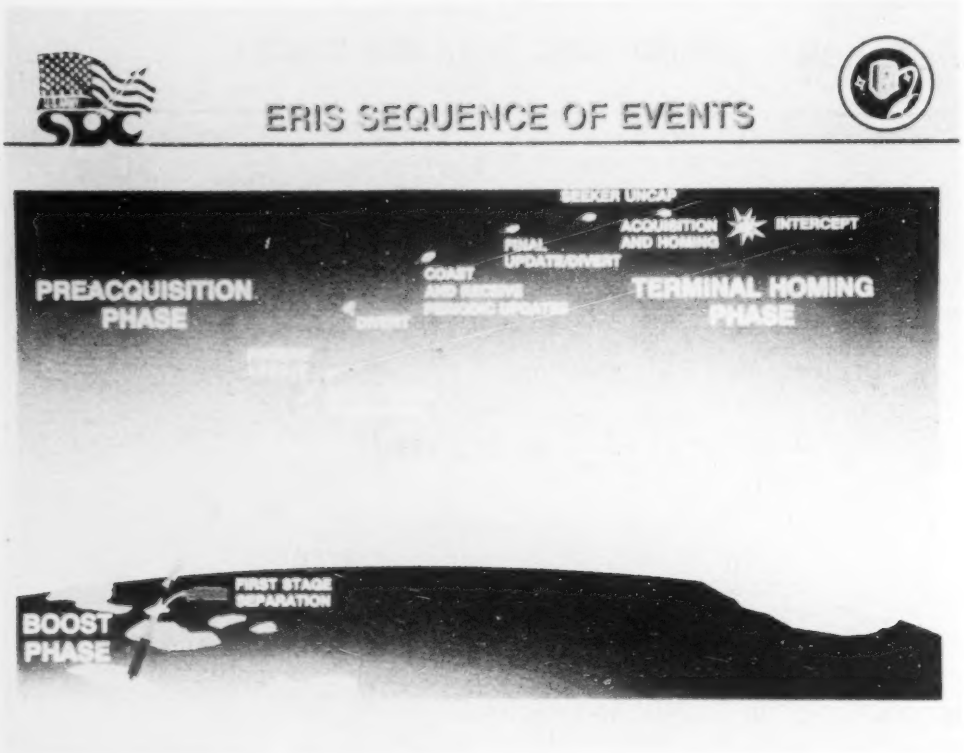
To begin with, the ERIS system is shown on this chart. The feasibility test and validation missile is located on the left and the baseline interceptor on the right. A man for size comparison is shown in the lower right hand corner. The ERIS baseline interceptor, the ERIS baseline is what SDI would eventually apply to the problem of midcourse exo-atmospheric interception.

ERIS stands for exo-atmospheric reentry interceptor system. The inset in the upper left hand corner shows the target set which the ERIS has to address for SDI applications, namely a complex set of reentry vehicles and decoys. The targets are one of the things that is not the same as ERIS recognized for ASAT would have to be addressed. In fact one of the modifications needed is homing against a single satellite target versus the ABM multitarget set, shown in the chart.



ERIS is a hit-to-kill system. [Deleted.]

Other pertinent elements of the ERIS system include propellant tanks to provide last minute course adjustments, seekers for use in the end game, and avionics—an autopilot, that sort of thing.



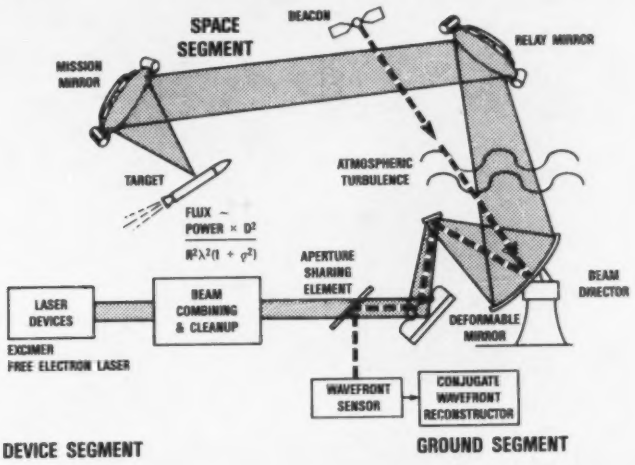
Let me discuss the scenario with which ERIS proceeds to do an intercept. ERIS requires from a radar a so-called handover basket or commit basket that permits a determination of the impact point prior to launching. That basket is again one of the items which is different between a potential ASAT application of the ERIS and the BMD application. I will discuss the differences in that handover basket in just a second.

The commit basket determines when the ERIS is launched. Once launched, ERIS is oriented toward this handover basket and then opens its eyes, so to speak. Its seeker acquires the target and it goes into the so-called end game, makes terminal homing corrections, and hits the target.

The handover basket based on planned SDI ABM systems is on the order of [deleted]. The available information from SPADATS for ASAT targeting information is [deleted] than it is for BMD.

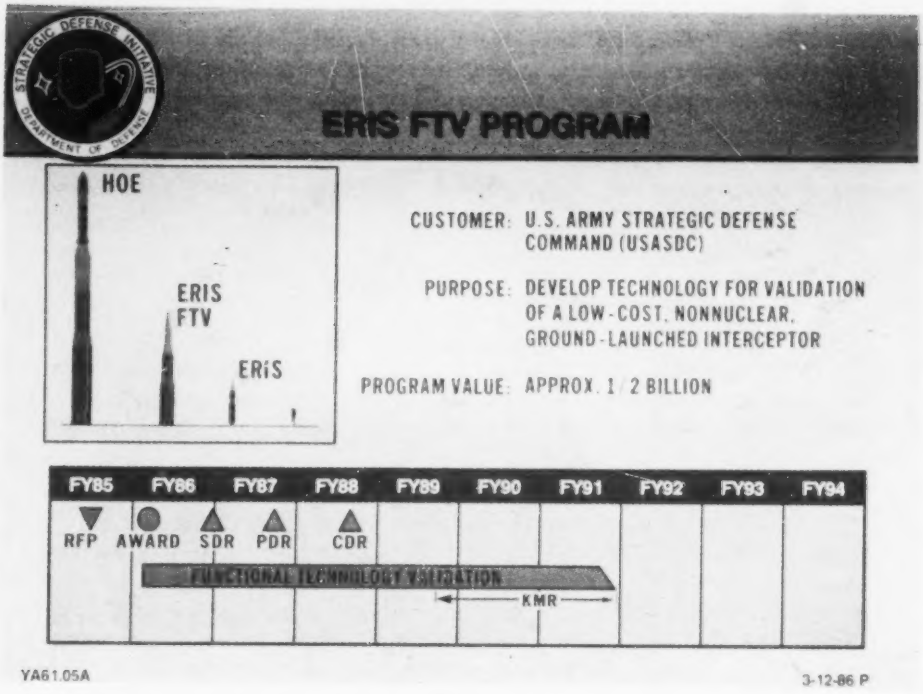
Therefore, one of the things that ERIS would have to do in an ASAT application is to essentially scan the volume of uncertainty as to where the target is. It is judged to currently [deleted].

GROUND BASED LASER BMD CONCEPT



Let me talk a little bit about program schedule and cost for ERIS, since that is instructive with respect to a potential use for modification for ASAT. The vugraph shown indicates the current test program funded under SDI for [deleted.]

The missile used for that set of validation experiments is in fact conventional propulsion. The ERIS two and three-stage missiles, as shown on the left, is considerably larger than the final operational system. In fact, the missile in the insert on the left (the ERIS FTV) has a total weight of [deleted] and a kill vehicle weight of [deleted.]

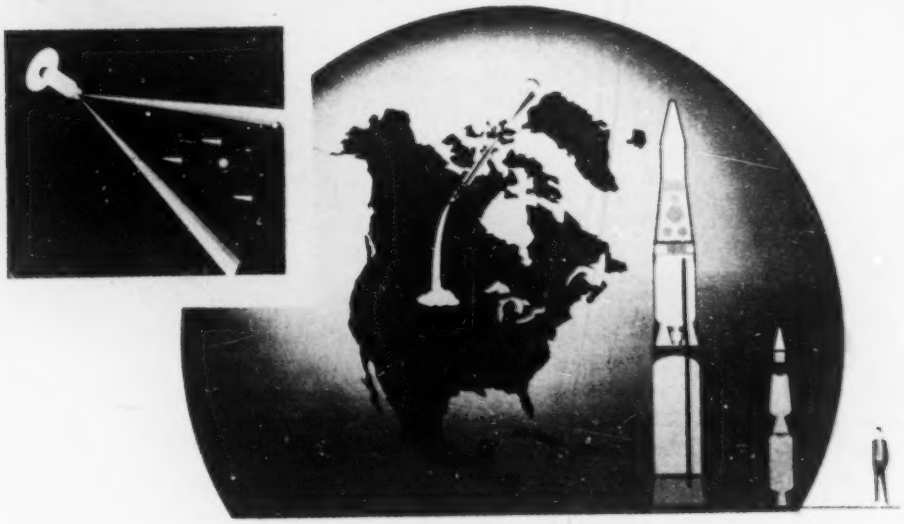

ERIS FTV PROGRAM
HOE
ERIS FTV
ERIS
CUSTOMER: U.S. ARMY STRATEGIC DEFENSE COMMAND (USASDC)
PURPOSE: DEVELOP TECHNOLOGY FOR VALIDATION OF A LOW-COST, NONNUCLEAR, GROUND-LAUNCHED INTERCEPTOR
PROGRAM VALUE: APPROX. 1/2 BILLION
FY85 FY86 FY87 FY88 FY89 FY90 FY91 FY92 FY93 FY94
RFP AWARD SDR PDR CDR
KMR
YA61.05A
3-12-86 P

The SDI schedule, BMD application schedule, involved on those [deleted] flights, is shown on this chart, as is the total value of the ERIS contract to Lockheed Corp., which is about $500 million.

One sees here that the tests in the BMD scenarios, the flight tests are at the Kwajalein missile range, are conducted in [deleted]. The modifications, if they were undertaken, that I discussed for ASAT type applications in our estimate would add at least [deleted] to that schedule.

[Deleted.]

ERIS - A GROUND-LAUNCHED, NON-NUCLEAR, EXOATMOSPHERIC INTERCEPTOR CONCEPT



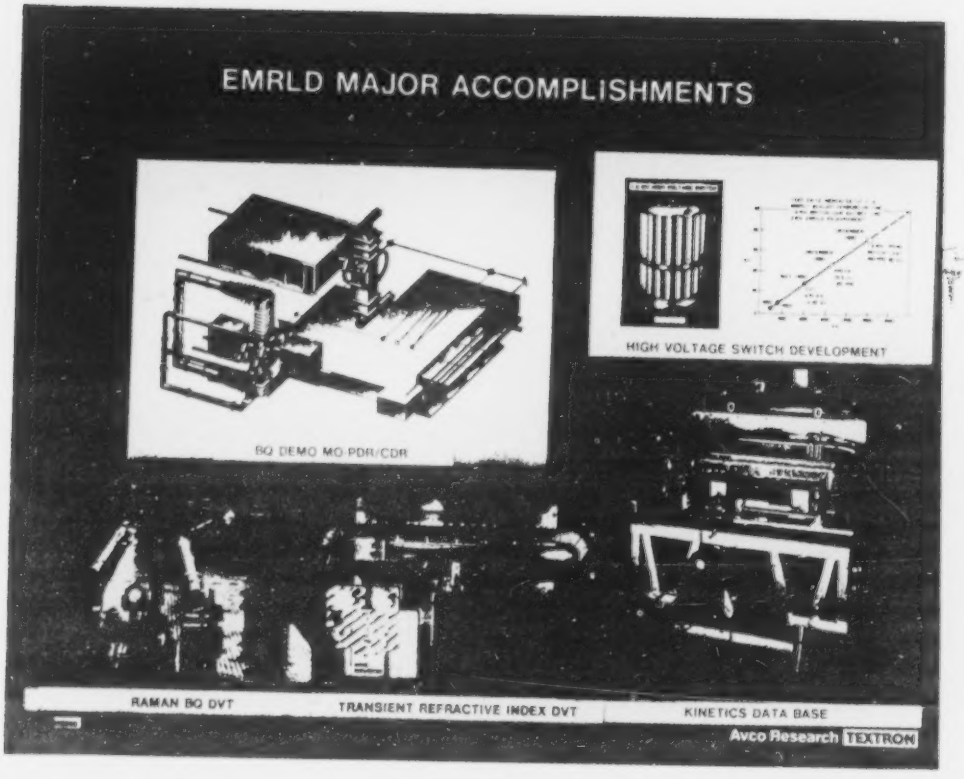
I am going to now turn to the directed energy area and discuss some of the ongoing laser programs relative to ASAT which are funded within SDI. This chart—and I apologize for its complexity—merely indicates, though, if you look at the major boxes, what is involved with directing a ground-based laser to a space target, in this case a target which is a missile, a boost-phase ballistic missile.

In order to get the beam to that missile, one bounces off one or two mirrors. Note, however, that there is something good in that relatively long, arduous path. That is, that the mirrors are cooperative targets. One can place beacons up here to provide information regarding the turbulent state of the atmosphere through which one must correct the beam.

There is the mirror. You need to correct the beam for the turbulence, the waviness of the atmosphere, the optical waviness of the atmosphere.

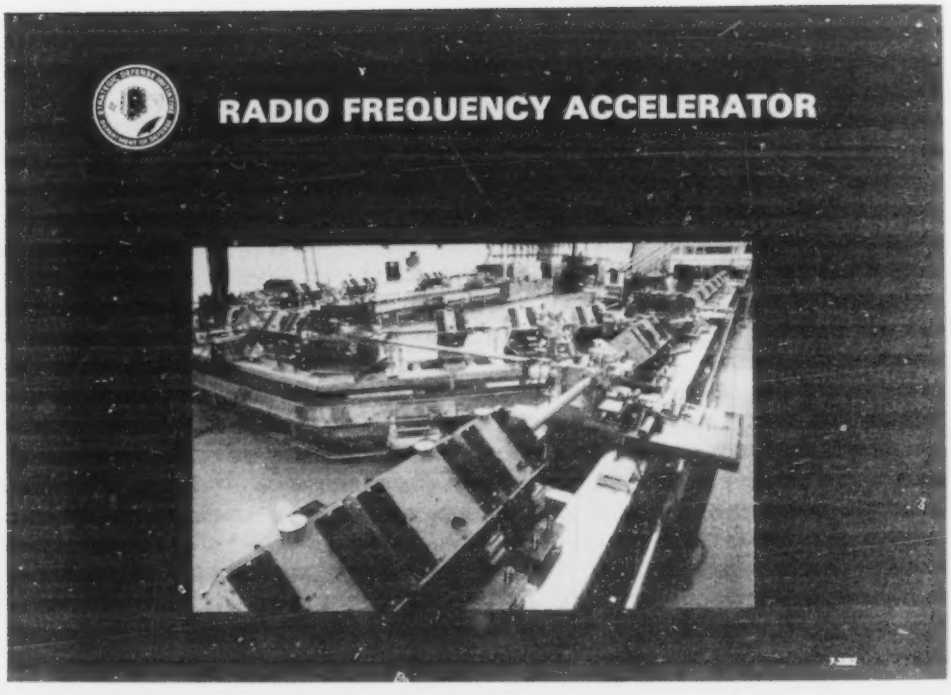
In an ASAT role, one, of course, is looking at dimmer targets without beacons, so modifications to the ground stations of ground-based lasers for SDI types of applications are required to achieve an ASAT capability using only the ground station.

We have serveral options for this box here, which is, of course, the laser device, and I will now discuss several of those.



These are pictures of the hardware around a drawing of the EMRLD device, which is the system which General Rankine alluded to in the excimer area, that we were working on jointly with the Air Force. We have in fact evaluated excimer technology for its ASAT application. Funding reductions within my program forced us to greatly diminish the excimer funding.

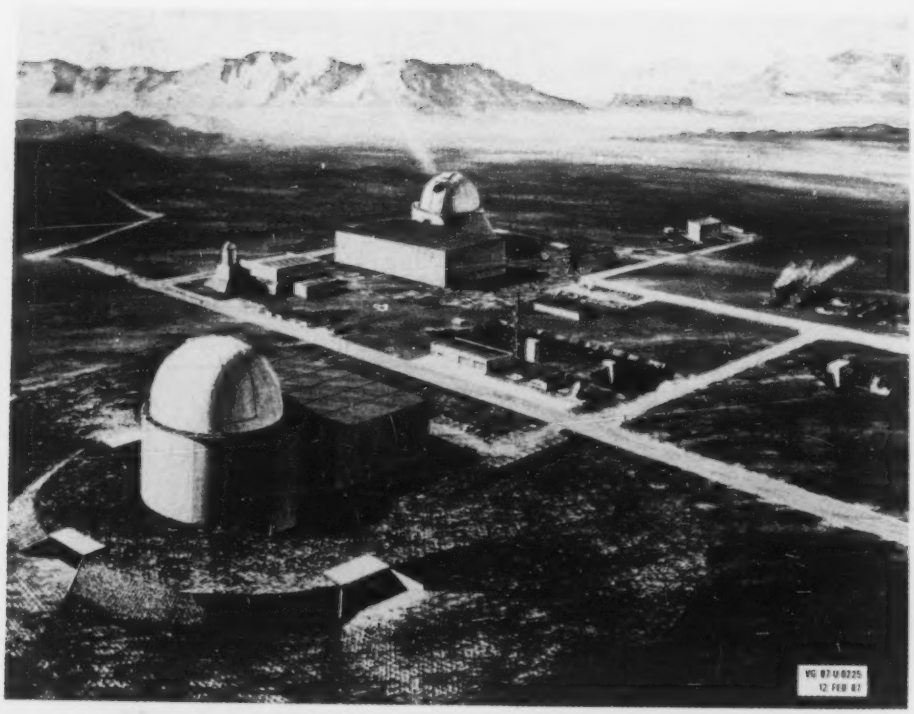
However, we have not gotten back on track [deleted].



The other area and the one which really has, I think, the best potential for higher altitude operations is the free electron laser program. This is one of the free electron laser devices currently under consideration, and I show it primarily to show that A, this technology is in a lab status and B, we are getting some results, and with fairly complex and interesting hardware.

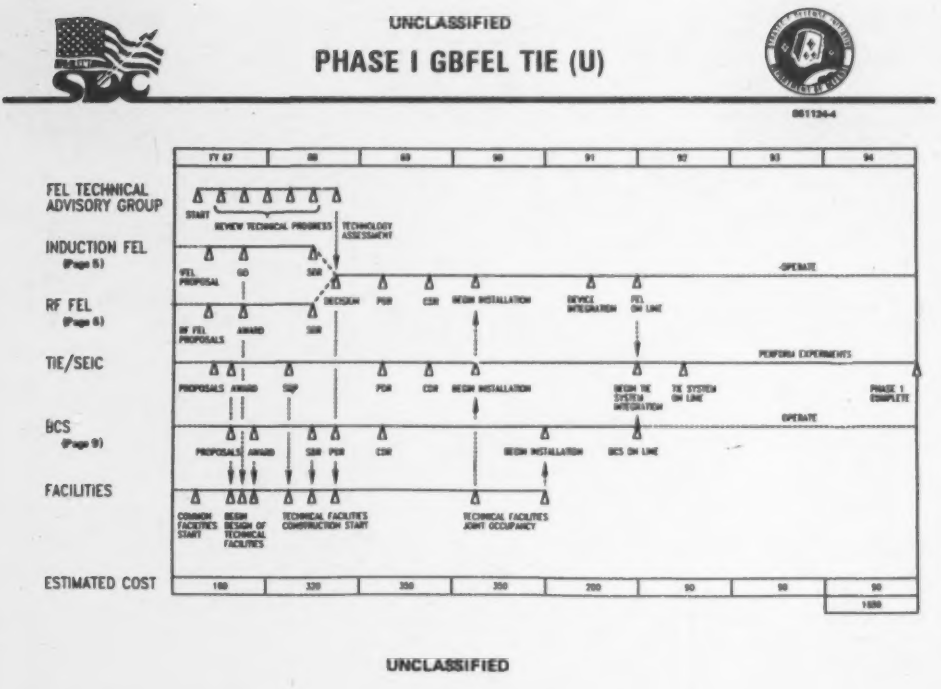
This is radio frequency accelerator. The general principle of the free electron laser is to use a free state electron, a traveling accelerated electron, which is wiggled between magnets in order to make it emit radiation, as opposed to getting radiation out of atomic transitions or molecular transitions in gas phase in the previous system.

This system is located at Boeing. The electron beam travels around this horseshoe-shaped band and through the wiggler magnets located here. The optical beam is then extracted in line with that wiggle.



Current plans call for developing two types of technology, the radio frequency linear accelerator which I just described and the induction linear accelerator, which I am not going to address here in detail. We will make the selection between those two on a schedule that I will show in the next vugraph, and locate a demonstration system at White Sands Missile Range. The site has recently been selected. This test bed will operate roughly a [deleted] device with a [deleted] beam director as the first stage of demonstrating free electron lasers for ballistic-missile defense applications.

This would be the subsequent device shown here in this particular dome.

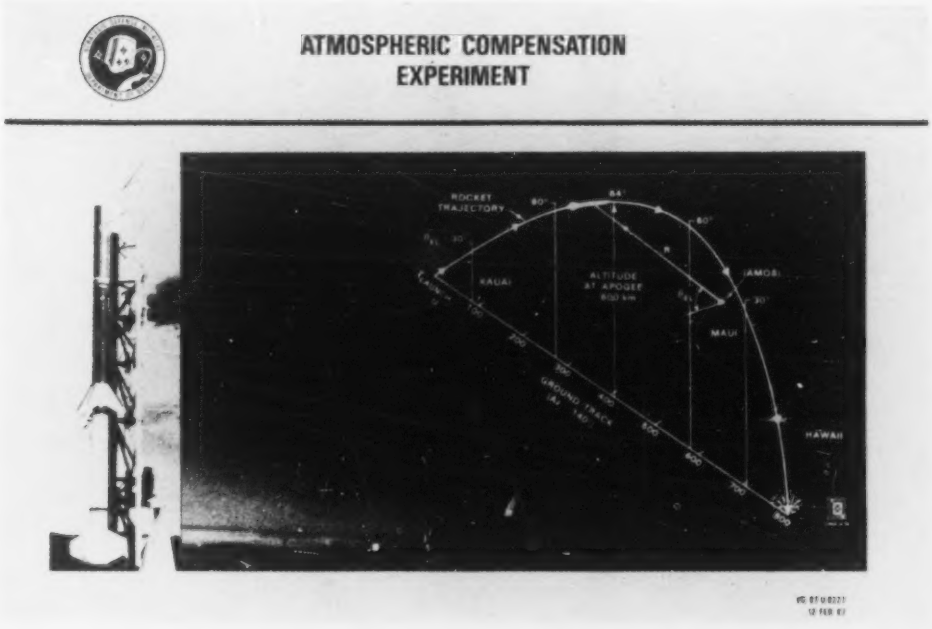


The early device—that is, the [deleted]—does, with the modification of the technology, have the ability to [deleted].

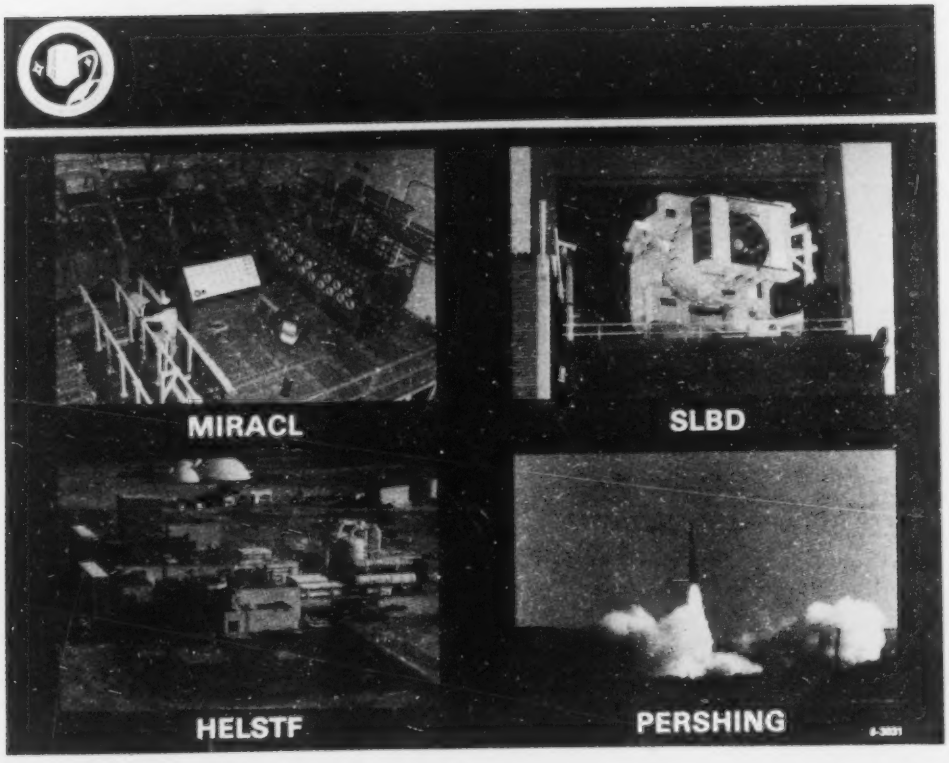
Again, I apologize for the complexity of this slide. This merely points out the competition between the two types of free electron laser technology, the selection into one, the incorporation of that laser device with the laser-beam control system, the BCS shown here, incorporation of those two items in the facility shown here by a technology integration contractor as shown on this slide, with testing of the combined system—that is, the direction of the beam from ground to space, with compensation against a cooperative target, that is not in a true ASAT mode, [deleted].

The technologies which we are looking at jointly with the Air Force in adaptive optics and advanced compensation techniques could be added to this device, [deleted]. Again, it is anticipated that that would add [deleted] to that schedule.

And again, I point out that this test would be a test of [deleted].



Moving quickly, I did want to mention that we have done low-power compensation for uplink propagations of lasers. This is done at Haleakala. A visible laser, low-powered laser, has been compensated against a rocket target, and so we do have a good basis for believing the types of schedules that we are showing for this program.



Finally, I would mention the chemical laser technology. There is in existence a [deleted] chemical laser. This is a longer wavelength laser. It has less attractive beam-focusing properties than do the shorter-wavelength free electron and excimer lasers.

However, this device is operating at the [deleted] level, as shown here, and it is connected to a beam director shown here on the right. For completeness sake, if compensated [deleted].

It lacks [deleted].

FLUENCE CONTOURS—2 KJ/CM^2 DEPOSITION IN 100 SEC*

[Chart deleted.]

When we assess the capabilities of these systems, we tend to look at the amount of fluence—that is, the total energy per a given area—that could be deposited in a certain amount of time, which is consistent with the amount of time that the satellite takes to fly overhead. One then develops this type of footprint with fluence contours, and I show on this some of the systems that I have talked about, namely if fully compensated, modified for compensation, what the chemical laser can do and what the free electron laser could do [deleted] where the curves were similar.

So one sees here the idea of growth potential of the free electron laser type technologies.

That concludes my charts which I brought and my comments at this time.

[The prepared statement of Mr. Hammond follows:]

PREPARED STATEMENT OF JOHN F. HAMMOND, DIRECTOR, DIRECTED ENERGY OFFICE, STRATEGIC DEFENSE INITIATIVE

INTRODUCTION

This statement summarizes ongoing technical activity within the Strategic Defense Initiative (SDI) which has relevance to the antisatellite (ASAT) area. First in the Kinetic Energy (KE), and then in the Directed Energy (DE) weapon area the principles of operation for Ballistic Missile Defense (BMD) and ASAT are outlined and key related SDI programs elements are identified. The status and schedule for technology development is discussed to give some indication of when derivative ASAT system components might be available.

During the formulation of the restructured ASAT program discussed earlier today by Brigadier General Rankine, the considerations outlined below were provided to the Air Force by SDI, and continue to be discussed and coordinated in detail. In general, the conclusion is that several SDI technologies are, with varying degrees of modification, promising for ASAT applications, but on a time scale certainly longer than that for the current air launched miniature homing vehicle (MHV) system.

KINETIC ENERGY

The homing overlay experiment (HOE) of 1984 first demonstrated the concept of exoatmospheric hit-to-kill of a reentry vehicle. The ERIS program represents the engineering refinement of this concept and progresses from design and laboratory subcomponent testing to a series of treaty compliant functional test validation (FTV) experiments to be conducted in 1990 and 1991. As such, the ERIS baseline operational design, as well as the vehicles for the FTV program, have been optimized on the basis of BDM considerations regarding target signatures, handover volumes, cost per kill, etc. Since the parameters for engaging orbital statellite targets are similar to those for reentry vehicles, the same technology can, in principle, also apply to an ASAT optimized design. An important question is whether the current (or even a slightly modified) ERIS design has any ASAT capability and/or desirable ASAT system features.

To address this issue, the general sequence for an ERIS target engagement is instructive. First the location of a predicted impact point is computed with some uncertainty (called the handover volume) based on track information. This track data in the case of BDM might come from [deleted]. ERIS flies toward this volume and then acquires the target with its onboard homing sensor, which is cooled from the dormant canister pre-launch state during flyout. In the case of BMD, this target may actually be a set of objects consisting of a reentry vehicle and other associated hardware or decoys. [Deleted].

If ERIS were required to fly an ASAT engagement with the same satellite track data specified for the MHV system, modifications would be required. The stated handover volume to the MHV is [deleted] although questions have been raised as to whether this might be improved. Under this constraint, ERIS would have to be programmed to scan its homing sensor over this volume in order to acquire the target. [Deleted.] Also, the onboard computational capability would have to be programmed to conduct and analyze the data from this scan, instead of being used for the abovementioned BMD aimpoint selection function. Finally, a following (as opposed to head-on), trajectory might be required to provide enough time for these operations and to possibly minimize the divert propulsion fuel requirements.

While such modifications are generally not severe, they would impact the overall ERIS schedule by up to an estimate of [deleted]. It is also noted that the modifications and schedule slip would be significantly reduced if the size of the stated handover volume decreases, possibly though the use of newer tracking technology or faster update rates. In any event, one would not anticipate starting modified FTV flights earlier than the [deleted] dates scheduled for the current ERIS program.

For completeness, the technology associated with the space based kinetic kill program should also be mentioned with regard to its ASAT mission relevance. Although intended primarily for boost phase applications, the extremely small, lightweight kill vehicle technology being developed could eventually pay dividends in future versions of ground launched KE interceptors from both BMD and ASAT applications.

DIRECTED ENERGY

In the laser area, several technical aspects of the ASAT and BMD missions are notably different. BMD generally requires higher ground-based laser brightness

than ASAT (loosely defined as the laser power aperture product divided by the square of the wavelength), while ASAT has more complex beam control and precision pointing problems than does the BMD ground to space mirror link. Even so, commonalities certainly exist such as the need for higher power laser devices and high power optics. The AF and SDI have worked closely to insure that recommendations for the restructured ASAT program efficiently develop such technologies in coordination with the SDIO. There are four main areas with ground-based laser ASAT relevance which receive SDI funding: excimer lasers, free electron lasers, adaptive optics and deuterium floride (DF) chemical lasers. Each of these are discussed in turn below.

The excimer laser program is jointly funded with the Air Force, and has as its main effort the completion and testing of the EMRLD device at approximately the [deleted] level at White Sands Missile Range [deleted]. Data from this device and an associated beam director can contribute very significantly to the design of future modular ASAT systems at the [deleted] level and BMD systems at the approximately [deleted] level. In addition to device physics, device engineering and output beam combining information, EMRLD also has potential for obtaining atmospheric propagation data.

The free electron laser (FEL) is funded by SDI and is focused on a high power demonstration at the [deleted] level in [deleted]. Two technologies based on radio frequency and induction linac electron accelerators are being evaluated for incorporation in this effort, which will also be conducted at White Sands. In [deleted] this device will be mated with an approximately [deleted] beam director, and the resulting combination will have sufficient brightness to be consistent with low and mid-orbit ASAT. In order to consider testing in this mode, however, significant additions to the pointing, tracking and compensation subsystems are required [deleted]. Such additions will be evaluated as the experiment design proceeds. The experiment, albeit high brightness, has not been analyzed in the context of any operational ASAT system requirements.

Adaptive optics, including wavefront measurement and wavefront correction components, are needed for both ASAT and BMD lasers. This area, like EMRLD, is being jointly funded by the Air Force and SDI. In general, components to support ASAT applications should be available by the end of this decade.

The only United States ground-based deuterium fluoride chemical laser of ASAT interest is the MIRACL device at White Sands. It currently operates at about [deleted] output with an approximately [deleted] telescope. If modified for satellite tracking, pointing and atmospheric compensation, it could probably damage [deleted]. The major limitation of chemical lasers for ground-based ASAT comes with [deleted]. Conversion of MIRACL for testing against orbital targets could be accomplished by [deleted].

Finally, it should be noted for completeness that ASAT can also be conducted with space-based directed energy devices. Thus, many other SDI programs such as space-based chemical lasers and neutral particle beams have ASAT relevance, but on timescales longer than any of those discussed above.

Senator EXON. Does that conclude your presentation also?

Mr. HAMMOND. Yes, sir.

Senator EXON. Thank you very much for a very interesting presentation, gentlemen, by all of you.

Let me start out by saying that in my judgment—and I am sure it is the near unanimous feeling of this subcommittee and the committee as a whole—the question is not whether we are going to have some kind of an antisatellite system. I think we know that.

The argument—your argument is with the other body, not this one, on that. The question is, rather, what can we afford and how can we get this done the quickest? The fact of the matter is you have tried with the House of Representatives and you have not sold them on it.

Is it true that the ones we are developing under the SDI program could be tested without violation of either the ABM Treaty or the congressional antisatellite mandate?

General RANKINE. The ERIS can be tested, if we place it at Kwajalein, which is the recognized range under the ABM Treaty, in an

ABM mode. That would be permitted as long as we do not make it mobile to test it. It could not, however, be tested against a satellite target.

Senator EXON. But it could be tested against RVs?

General RANKINE. It could be tested against RVs. But if Congress sought to reimpose the ban in those years when the tests would be going on in the nineties, then that ban would prevent testing it against a satellite target.

Senator EXON. What you are saying, you think it is critically important that it be tested against both RVs and satellite targets?

General RANKINE. Sir, it is absolutely essential that you demonstrate the capability to intercept the target that you wish to intercept. If it is a reentry vehicle, you have to demonstrate that. If it is a satellite, you have to demonstrate that.

Senator EXON. And it follows then, does it not, General, that despite the testimony that you gave us, that the Soviets are necessarily 9 feet tall or 11 feet tall? Is it not true that, since they have only had about a [deleted] that that is not a success rate that they can be very satisfied with?

It certainly would not be a success rate that the Air Force would be satisfied with. While they have done some testing, they have stopped those tests as of now, have they not?

General RANKINE. First of all, Mr. Chairman, they have [deleted] actually demonstrated. Ours is designed for [deleted] and our targeting strategy is [deleted] would give them a much better capability [deleted]. So that is the way you would use that sort of a weapon.

Senator EXON. I hope that, and I took it from your testimony that, there is total understanding within the Air Force itself and with SDI, so that the right hand knows what the left hand is doing in this whole area. Are you all convinced that there is a complete flow of information and that we are not in competition one with the other, to the point that what the Air Force knows might not be totally known to SDI and vice versa?

General RANKINE. Mr. Chairman, the reassessment that the President directed was done with the full cooperation of the Strategic Defense Initiative Organization and was coordinated by the Secretary of Defense with the two organizations participating.

It is a coordinated position, that position which I presented to you.

General PIOTROWSKI. Mr. Chairman, if I might say that from an operator in the field, I am quite confident that we are very conversant with the SDI community, General Abrahamson and his staff, as well as the Air Force R&D community. So I believe we are conversant with the availability of technology and what is being pursued.

Mr. HAMMOND. Mr. Chairman, I would also like to make a statement that that coordination extends into the contractor community, and that we have actually had the contractors working on the SDI application and on the ERIS looking at the availability.

And I believe Mr. Loomis from Lockheed had testified as to some of the capabilities.

Senator EXON. Let me then ask this next question. Now, I have heard all of these statements about the President's budget includ-

ing this, the President's budget included this, and I think your statement is totally accurate. The problem is that the President's budget, right, wrong, or indifferent, has not been funded.

NEED OF MHV AND AIR SYSTEM

And in my view, it is not going to be funded this year. So that brings us down to something that you do not have to worry about, but we have to worry about on this side of the table. Are you all convinced that we need both an MHV and an air system to fill the void that we have in this area today?

General PIOTROWSKI. Senator, Mr. Chairman, as the operator I am absolutely convinced that, in order to redress the imbalance, we need an operational antisatellite capability and that we need one soon. The great asymmetry that exists in [deleted] capability on the part of the Soviets vis a vis the United States, their ability to launch on demand with great rapidity—they have the capability to launch, for example [deleted].

[Deleted] at their launch facility. The intelligence community believes that at least [deleted].

It appears clear to me that, should a conflict occur, the Soviets could do enormous damage to [deleted] and our ability to enhance our terrestrial force capability by providing them the necessary information they need.

They could deny us that capability. We have no way to influence their ability to reconnoiter our forces or to target our forces, and I hope that point came across clear. The EORSAT, RORSAT, [deleted] have the capability for targeting, [deleted] so they can launch over the horizon weapons systems that can, with that information, acquire and successfully attack our ships. So there is great asymmetry.

In order for me to do my job, in order to provide space control, space support, and force enhancement, the United States needs an antisatellite capability.

Senator WARNER. I guess it also addresses a time gap. It seems to me your question asked that.

General RANKINE. Yes, Mr. Chairman. If I may, that time gap would be [deleted]. Waiting for ERIS would extend the time gap a minimum of [deleted] before the United States could have an operational ASAT system. And since we already have been experiencing a disparity in our capabilities with the Soviets, that is—[deleted] is based upon not using the production version of the ERIS, but using the flight test version, which is not the cheap version.

Senator EXON. Gentlemen, we are trying to move along and I will try to get back to this in a second round. I am not sure that I buy totally that [deleted] proposition. We hear all kinds of things about wonderful successes coming out of SDI, and maybe this is one of the wonderful successes that will speed it up.

But I am not going to go over my time. Senator Thurmond.

Senator THURMOND. Thank you, Mr. Chairman.

ASAT MORATORIUM

General Piotrowski, supporters of the ASAT moratorium have argued that such restraint will prevent the militarization of space.

Could you comment on the degree to which space is already militarized and how the U.S. ASAT program could change the status quo?

General PIOTROWSKI. Yes, Senator Thurmond. I believe it is clear that, with the advent of the German V-2 rocket or short-range ballistic missile, space was turned to military purposes, and has been used so ever since. Both the Soviets and the United States and other nations, of course, use space because it is appropriate, it is necessary, it is vital to our national interest.

It is a growth industry. And so I do not believe that the arguments are well-founded that space is not being used for military purposes today. It has been for more than the past 20 years.

TESTING MORATORIUM

Senator THURMOND. General Rankine, what effect has the testing moratorium had on the conduct of the development program? Are we wasting time and money now?

General RANKINE. Yes, Senator, we certainly are. The 2 years of prohibition against testing in space has had a day-for-day slip in the date at which we can employ this important capability. We estimate that the delay incurred as a result of not being able to test against objects in space this year causes another $208 million increase in the cost of the RDT&E.

Senator THURMOND. Mr. Hammond, what is your estimate of additional costs associated with giving ERIS an ASAT capability?

Mr. HAMMOND. A detailed cost estimate, of course, had not been developed, at least to my knowledge. The modifications that we are talking about here, as I mentioned, are primarily to the [deleted] and testing against a different set of targets.

I would anticipate that such modifications could get the missile ready—to get the missile ready, would be a fraction of the cost of the current ERIS FTV program. I would not want to venture as to exactly how small that fraction would be. I would not anticipate it being another 50 percent, for example.

Senator THURMOND. General Piotrowski, I understand that the Soviets are making increasing use of space assets that provide [deleted] of terrestrial forces.

Can you comment on the means we have today, if any, to deny the Soviets these eyes and ears in the sky? And how confident are you in the continued effectiveness of these means, if any, in the face of Soviet countermeasures?

General PIOTROWSKI. Senator Thurmond, I think just a simple comparison of a few years ago the Soviets had 120 satellites of military utility in space; today they have about [deleted]. And that varies, fluctuates as much as four or five a day depending on their de-orbit and launch rate.

I am confident that they have the capability in times of crisis—and we have seen them do this in exercises, [deleted].

At the present time, we have the ability to [deleted]. That is the only capability the United States has today to deny the Soviets the use of their satellites.

Senator THURMOND. General Rankine, last year the cost of restructuring the program and certain testing anomalies prompted

some Members of Congress to declare the system a turkey. I do not share that view, but I would ask you to respond to that criticism.

General RANKINE. Would you repeat that, sir? I missed the word that you used.

Senator LEVIN. Turkey.

Senator THURMOND. Do you want me to repeat the question?

General RANKINE. I missed the word "turkey," sir. Thank you.

I do not think it is fair to call it a turkey when the only test we have been able to conduct against an object in space was a success. We are one for one so far. Now, that is not enough to assure that we are ready for production. It is not enough to assure the operator that it is operational. And it is not enough to deter the Soviets, we fear.

But nevertheless, I think we have demonstrated with that and the two subsequent shots that we had in the last year that the system is definitely not a turkey, and that the problems, technical problems which we have been experiencing, have been properly addressed.

U.S. DEPENDENCE ON SPACE ASSETS

Senator THURMOND. General Piotrowski, the conventional wisdom is that the United States is more dependent on space assets than is the Soviet Union. What is your assessment of this situation today, and what are the trends for the future?

In your judgment, how does more or less dependence on space assets bear on the issue of whether or not to test and deploy an ASAT system?

General PIOTROWSKI. Well, sir, both the Soviet Union and the United States depend heavily on space systems to provide [deleted]. The Soviets in their military satellites outnumber us roughly two to one. They have the ability, as I mentioned earlier, to launch several satellites a day, and they have demonstrated this repeatedly.

Our ability to replace our satellites has been seriously degraded as a result of the great tragedy we suffered with the Challenger. We are moving full speed ahead, as you well know, and with the support of the Congress, to purchase the medium-expendable launch vehicle, which will give us a dual capability to get into space.

But in a crisis today or in the near-term future, the United States has very little capability to replace any satellites that would be lost as a result of Soviet antisatellite capability. We could be blinded and they could robust their capability, with no way for the U.S. to respond in kind at this time.

Senator THURMOND. Mr. Chairman, my time is up. Thank you very much.

Senator EXON. Thank you very much, Senator.

Senator Levin.

SOVIET ASAT CAPABILITIES

Senator LEVIN. Can you tell us what capabilities the Soviet ASAT has against our important military satellites? Are our important military satellites now vulnerable to the Soviet ASAT?

General PIOTROWSKI. Those that fall within the altitude regime.

Senator LEVIN. What percentage of them do and what percentage of them do not?

General PIOTROWSKI. The geosynchronous satellites do not.

Senator LEVIN. What percentage of our satellites that are important to us militarily are outside of the Soviet ASAT capability?

General PIOTROWSKI. Can I submit to you a specific number?

Senator LEVIN. A rough guess.

General PIOTROWSKI. The catch word, sir, is important military satellites, and that is in the eye of the beholder. My estimate right now is [deleted] percent.

Senator LEVIN. [Deleted] of our important military satellites are now vulnerable to Soviet ASATs?

General PIOTROWSKI. Yes, sir, in the aggregate, Senator Levin, that is approximately correct. [Deleted.]

Senator WILSON. That is the [deleted].

Senator LEVIN. So [deleted] of the militarily important satellites and [deleted].

General PIOTROWSKI. [Deleted.]

Senator LEVIN. Are vulnerable?

General PIOTROWSKI. Yes, sir. [Deleted] percent in the aggregate of total militarily important satellites, [deleted].

Senator LEVIN. Now, what countermeasures can we take against the Soviet ASATs in order to protect the [deleted] that are vulnerable?

General PIOTROWSKI. Senator Levin, what we have the capability to do today is of course to detect a Soviet ASAT launch, determine what satellites are in the window that are vulnerable to that threat, inform the user-owner of that particular spacecraft, and should that spacecraft have the ability to maneuver and maneuver over a fairly wide range, then the owner-user could maneuver that satellite.

I must tell you that the range that it would have to maneuver could be fairly significant, and in so doing would probably reduce the life of the satellite and maybe even take the satellite out of existence. By maneuvering, in other words, you would expend the propellant that is available to point and use the satellite. So it may be self-defeating.

COUNTERMEASURES TO PROTECT OUR SATELLITES

Senator LEVIN. Should additional countermeasures be taken to protect our important satellites?

General PIOTROWSKI. In my view, as an operator, clearly we should take every measure possible to harden and protect satellites. And I would defer to General Rankine, who is the developer here, as to what can be done and what that entails in terms of costs and total satellite weight.

But against the Galosh weapons system, which is a nuclear weapon, it would be difficult to harden. And it would also be difficult to harden against a kinetic energy weapon, such as the Soviet ASAT.

Senator LEVIN. Are you saying that we have done everything we feasibly can to protect our satellites? I am not sure what you are saying.

General PIOTROWSKI. No, sir. I am saying that the protection against a nuclear weapon in space is not a trivial issue. It would be a very difficult thing to do. And to protect against a kinetic energy vehicle such as our miniature homing vehicle or the shotgun approach that the Soviets have is also difficult.

But I would defer to General Rankine and Dr. Hammond as to how that might be done and the cost.

I would answer your question by saying we should do everything we can that is possible and reasonable.

Senator LEVIN. If we put in the ASAT systems which you are looking at, would a Soviet SDI—would the Soviet SDI be vulnerable to those systems?

General PIOTROWSKI. Would a Soviet SDI be vulnerable to satellite protective systems?

Senator LEVIN. No, to our ASAT.

General PIOTROWSKI. Would a Soviet SDI be vulnerable to our ASAT? If it were an orbitable system that came within the [deleted] range of our ASAT, I believe the ASAT would have the capability to fly in front of it.

But again, I would defer to the developer.

Mr. HAMMOND. I might take that question and answer, of course this is of extreme interest to SDI: Is our SDI system vulnerable to the Soviet ASATs? We have looked at that issue.

SOVIET SDI VULNERABILITY?

Senator LEVIN. Let us go at it the other way around. Is the Soviet SDI vulnerable to our ASAT system?

Mr. HAMMOND. What is required and what evolves out of considerations of those sorts of vulnerabilities are an increasingly detailed set of moves and countermoves. Suites of countermeasures emerge like decoying the SDI system in order that a Soviet nuclear ASAT would not know which target to go after.

That ASAT itself could be decoyed coming up, so that you could destroy the ability of the SDI system to maneuver out of the way because it does not know which is a real weapon coming after it.

There is a complex number of games like that which one can play and analyze. And in general, we think that for our SDI systems we are seeing our way clear to increasing the survivability against both nonnuclear as well as nuclear ASAT systems.

Senator LEVIN. If our SDI is going to be invulnerable to the Soviet ASAT, why should not their SDI be invulnerable to our ASAT?

Mr. HAMMOND. But the point is again, let me refer to the timeliness situation.

Senator LEVIN. I am just talking about conception.

Mr. HAMMOND. I do not think that, as with other countermeasures and counter-countermeasure games, we know the ultimate answer to that right now. But the point is we have an immediate problem.

Senator LEVIN. My time is up. Thank you.

Senator EXON. Thank you, Senator Levin.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

VULNERABILITY

One of the points that I want to pursue here has been made, and that is the vulnerability of [deleted]. From what you have said, I gather this is a little bit like climbing in the ring with another fighter, but with the added disability that [deleted].

If they have succeeded in knocking out [deleted] they would then be in a position to launch over the horizon attacks and you would have to hope that some radar would pick them up. But you would certainly be denied the kind of early warning that you would presently be able to have from those satellites.

General PIOTROWSKI. Sir, one would have to describe all of the uses of the satellites. [Deleted.]

And I have to agree that we would be [deleted] and it would be like stepping in the ring, as you suggest, with a prize fighter being [deleted].

DELAYING TESTING OF ASAT CAPABILITY

Senator WILSON. The other point I wanted to pursue is the one that General Rankine made. If I got your quote accurately, you said that delaying the testing of our ASAT capability is simply delaying the inevitable, that we have got to test against an object in space or face the fact that we are either going to be totally devoid of any capability or have to rely as an alternative on a nuclear capability.

General RANKINE. That is correct, Senator.

Senator WILSON. Well, I would like for you to expand on that, because I think the only two people who were here at the time were Senator Exon and myself. So you might just repeat that, because I think it is a significant point.

General RANKINE. Yes, sir, I would be glad to. With respect to the issue of the necessity of testing against an object in space, I said earlier that the only kind of an ASAT system in which you could have confidence without actually testing against an object in space would be a nuclear system, because you could be assured that you could have an envelope of lethality, if you will, a radius of kill, that would be so large that all that would be necessary to demonstrate is that the launch vehicle could put a dummy warhead within proximity of a point, within sufficient proximity of a point in space.

That is all you would have to demonstrate in order to have confidence. On the other hand, with respect to an interceptor or a laser, you have to demonstrate far more, because now you have to actually hit the satellite to kill it. You hit it with the interceptor or hit it with a laser beam, that is the most difficult part, the actual hitting of the satellite with the laser, pointing it accurately enough, getting it up through the atmosphere, or actually causing the interceptor to collide with the satellite, which is the most difficult part of what we call the end game, where the sensor has to critically track right up to the very last moment.

You cannot have confidence that you have an operational capability, you cannot even have confidence that you are ready to go into production for such a system, until you have adequately demonstrated that critical hit-to-kill capability is real.

Senator WILSON. When Senator Levin asked what we can do really to take adequate countermeasures against a Soviet attack, would it be your statement that whatever is available by way of maneuver and hardening is really secondary to what we would achieve if we had ourselves an adequate deterrent to discourage their attacking our ASATs?

General PIOTROWSKI. Absolutely.

Senator WILSON. And it is your feeling that, with no capability on our side, we are in effect inviting that attack, because there is no way that we have now to respond?

General PIOTROWSKI. Senator Wilson, that is exactly what I stated in my earlier comments, that we could be in effect inviting the Soviets to attack. We have no way to respond in kind. We can only absorb the blow, accept the loss. And the only options open are either horizontal or vertical escalation, or to respond some way out of kind, which may be misread by the Soviets as escalation.

Senator WILSON. And the difference in our situation and that of the Soviets is that they have achieved [deleted] on several tests, [deleted] and we have not tested. Therefore, [deleted] but we do not have at this point any confidence that it can achieve that because we have not tested it.

General PIOTROWSKI. That is correct, Senator.

Senator EXON. I do not think that is correct. We are at 100 percent, are we not, with our one test?

General PIOTROWSKI. We have had one success in one test, that is correct.

Senator WILSON. Against an object in space?

General PIOTROWSKI. Yes, sir. It was against a derelict satellite, on the 13th of September 1985.

General RANKINE. Senator, if I may clarify that. We have conducted five ASAT tests launching into space up to this point. Only one of those has been against an object in space. It was in September 1985, and it was against an Air Force satellite that was dying, and we used that as a target.

And it was prior to the time that the first moratorium was invoked by the Congress. It was a success.

But statistics indicate that one out of one is not sufficient to give either the United States or the Soviets any confidence in the operational utility of that.

Senator WILSON. If you were able to see an end to the moratorium that has been imposed, you would be scheduling for the coming year five tests, do I understand it?

General RANKINE. Three tests would be scheduled in fiscal year 1988.

Senator WILSON. Well, let me just ask you this. You have had 2 years of moratorium now. What is the effect of that in terms of delaying advances in technology? If you do not test, you do not learn what is wrong. You cannot go forward and cure.

How far ahead of the Soviets are we or how far ahead of us are the Soviets, as nearly as you can measure it in time?

General RANKINE. Well, sir, they began testing theirs in 1968. Somewhere well ahead of their 1982 test, we considered that their system was wholly operational, totally operational. If we could start our testing in 1988, we could begin operational capability, we

feel, in [deleted]. But that is 2 years later than it could have been if we had not had 2 years of delay in the testing against objects in space.

Our best chance right now is fiscal year [deleted]. The Soviets have been operational at least a decade more than that.

General PIOTROWSKI. And if I may add, Senator, the Soviets continue to exercise the booster that they launch their ASAT on, the [deleted]. They have launched it over [deleted] times since the [deleted].

Senator WILSON. And so in your judgment there is a clear Soviet intent to use their ASAT capability [deleted].

General PIOTROWSKI. That is correct, sir.

Senator WILSON. Well, Mr. Chairman, I think it makes it very clear that we are way behind in an area that is of particular sensitivity. If you [deleted] fighter in the ring, you are at a hell of a disadvantage.

Senator EXON. Thank you, Senator Wilson.

Senator Quayle.

Senator QUAYLE. Thank you very much, Mr. Chairman.

SPACE SURVEILLANCE

General, let me go back. I was quickly going through your statement and I did not see very much in here at all on the whole issue and importance of space surveillance. I think we talked about hitting Soviet satellites, but if in fact we are going to be able to hit them, I know and you know the importance of being able to have the confidence in our ability to acquire these targets.

What are we doing about our space surveillance capabilities? And is it not true that we are in fact, [deleted]. And if that is true, and I think it is true, should we not be placing more importance on our space surveillance capability, which I think is one of the prerequisites before we become very successful and embark on any type of antisatellite capability?

General PIOTROWSKI. Senator, you are very correct that surveillance is the first order of business.

Senator QUAYLE. Did I miss something? Was this stressed in your testimony? I went through this very quickly. Or is it an omission by inadvertence or an omission deliberately because you do not think it is something we need to concentrate on, or what?

General PIOTROWSKI. Neither of those, sir. It was in order to spare the time of the committee on this very important issue, from going into the background which, as you have well determined, is the prerequisite. Surveillance is a continuing and first order priority.

There are something like 6,534 objects in space that are in the Space Catalogue right now, another perhaps 1,000 that we are tracking back to origin, because one of the requirements is to determine where that space object or space debris came from.

And that is critically important to protect other satellites, to provide the necessary care and feeding of the satellites that we have responsibility for, to protect the space shuttle when it launches, to determine windows of safe launch for all objects, in fact.

And it is the first order of priority for launching an ASAT. One cannot launch against a target unless he knows where it is.

[Deleted.]

So that is worrisome. Surveillance is critical. I believe that it is also very important that we have the ability to deter the use of the Soviet ASAT and to be able to take out his [deleted] targeting capability with the EORSAT, RORSAT, [deleted] and his other reconnaissance platforms should a crisis occur.

PRIORITY ON SSTS

Senator QUAYLE. Where are we as far as the priority on SSTS, which I presume would be very important to aid space surveillance? What kind of emphasis are we giving to our space surveillance capabilities?

And as you just pointed out, it is a very fundamental high priority in any kind of developing a capability of ASAT.

General PIOTROWSKI. Well, I would defer to either General Rankine or Dr. Hammond in that regard.

Senator QUAYLE. What's our priority for SSTS or space surveillance?

General PIOTROWSKI. If we are going to talk about a space surveillance and tracking system that falls into the category of the antisatellite or, I should say, the antiballistic missile or Strategic Defense Initiative.

Senator QUAYLE. Well, that is not the only capability of that. That is the fundamental problem I have. I am not so sure that we have a clear understanding of the capability of the SSTS. Certainly it does have an application against ballistic missiles, but there is a lot more that it can do than just detecting ballistic missiles.

Is that not correct?

General PIOTROWSKI. With the capability that we have today, I would like to say that today in the space surveillance system, as far as keeping track of existing and projected Soviet satellites, the existing space surveillance network with the addition of a deep space warning radar or surveillance radar that could be placed in the Indian Ocean, Diego Garcia, somewhere in that area, then I believe that we could achieve all of our necessary requirements absent SDI.

DEEP-SPACE RADAR

Senator QUAYLE. Is the deep-space radar funded?

General PIOTROWSKI. The deep-space surveillance radar was not funded last year. It would be a new start this year.

Senator QUAYLE. Is that in the budget?

General PIOTROWSKI. It is being submitted by the U.S. Space Command.

Senator QUAYLE. Is it in your request before this committee?

General PIOTROWSKI. It is not in the request before this committee.

Senator QUAYLE. Why not? I mean, you just said how important it was. Why would it not be? If you do not make the request, it is going to be sort of difficult.

I know how the chairman operates. He wants to know exactly what is the requirement from DOD, is the Air Force asking for this, is the Secretary of Defense? And if it is not even in your budget, it makes it a little bit more difficult.

And I think this is a very important area of this whole surveillance, and I know that the Chair does as well. And I think that we have—we have not perhaps paid as much attention to it as we should. This is just one person speaking, but I mean, if we do not get the surveillance—we just went through how important the deep-space radar really is as far as getting further detection, and it is not even in the budget.

It is not even in the budget request. So I think this is an area where we probably have a lot of work to do, Mr. Chairman.

My time is up, but I find it a little, at least from my point of view, a little bit bewildering that we are not paying proper attention to this very, very important issue. I really think it is absolutely critical, as you have just said.

I think that we ought to look at some of our priorities, and particularly given the resource limitations that we have.

General PIOTROWSKI. I would appreciate your support on that very important issue, sir.

Senator EXON. We unfortunately are going to have a hearing on that very subject, but it is after the markup.

Senator QUAYLE. Well, at least we will have a hearing on it.

Senator EXON. The vote is on. I am going to try to get a quick second round in with one question from each Senator, and we will try to hold it down.

REQUESTED TESTING FUNDING LEVELS

For General Piotrowski or General Rankine: I serve not only on this committee, but on the Budget Committee, and so therefore I have all these problems that we have to wrestle with as a group here. If we are unable to end the moratorium on testing for 1988 and 1989, what would you recommend that we do about your requested funding levels?

Should we cut them back or eliminate them, or what should we do?

General RANKINE. Sir, we simply must not let that happen. The importance of the ASAT to the U.S. deterrence of conflict is so important that I feel we just simply must not allow that to happen. Somehow we have got to get that idea across to the Congress and make it clear that the need is so great that this should be one of the highest priorities in the Congress to fund.

Senator EXON. Well, I tend to agree with you, General, to some extent. If nothing else this morning, it has been made very clear here that if we are going to proceed with this program we have to have tests.

If we cannot get tests, for whatever reason, I wonder, with the constraints that we have, which way we will go.

Senator Thurmond, do you have anything further?

And by the way, there will be some questions for the record. We are going to try and wind up here, and we would ask you to respond to those as promptly as you can, before the markup.

Senator THURMOND. Just one question, Mr. Chairman.

RESEARCH FUNDS FOR GROUND-BASED LASER

General Rankine, this year the budget request includes research funds for the ground-based laser in the same account as the miniature homing vehicle ASAT program. I do not believe it is a good idea to combine these two very different programs in a single program element.

Is the Department of Defense taking any actions to provide a separate account for the ground-based laser activity?

General RANKINE. Yes, Senator. We have already taken action to reprogram the funds from the ASAT account into program element 63605, which is the account that we use in the Air Force to do laser research.

Senator THURMOND. Thank you, Mr. Chairman.

Senator EXON. Thank you very much.

Senator Wilson.

Senator WILSON. Mr. Chairman, I think I have asked most of my questions. I will simply thank these gentlemen and say that I am pleased to hear that you are going to have a second hearing, because I think this is such a critical area and one that the Congress has not only neglected, but it has been distinctly counterproductive in.

We do not know what damage we have caused with this 2-year moratorium, but we certainly have widened the gap between our capabilities and that of the Soviets, at great peril to all of our services, and perhaps most immediately to the Navy.

Senator EXON. Thank you, Senator.

Senator Quayle.

Senator QUAYLE. Thank you, Mr. Chairman.

ASAT CAPABILITY

I would just ask one question, General, concerning the importance of us having an ASAT capability. Would it not be important to us for the reason to be able to hold their lower satellites at risk, particularly as they try to target our mobile C^3I nodes.

If they can hold them at risk, wouldn't they be able to decapitate our forces? Would it not be in our interest to have the ability to deny them that capability with an ASAT of our own?

General PIOTROWSKI. If I may, I would rephrase that just slightly. From my standpoint, I would say: first, to deter the use of their ASAT to deny us our ability to [deleted] and second, should a conflict erupt, to do exactly what you say, not only hold their satellites at risk but to take out their capability to target our forces, both at sea and on land, and our C^3 with their ELINT satellites.

Senator QUAYLE. I agree with that and I think it is a very important point and one that does not get voiced very often. Unless I missed something, I have not heard that today. Maybe it was earlier on. I came in late and I apologize for that, Mr. Chairman.

But I think that is one of the issues and I understand the first issue, but it is a second and very important issue, and I do not know if it has been said. And if it has, good; and if not, I hope it is said more often.

General PIOTROWSKI. It was not said as well as you did it, and you are exactly right.

Senator QUAYLE. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Quayle.

And thank you, General Piotrowski and General Rankine and Dr. Hammond. And this was a very, very interesting discussion, and I congratulate you on your presentation. I think there is an awful lot of sympathy and understanding of your position and how important it is here.

And I have tried to impart to you that we have an awful lot of pressures on us here. But you have been very forthcoming in your presentation this morning, and we thank you.

[Questions for the hearing record with answers supplied follow:]

QUESTION SUBMITTED BY SENATOR J. JAMES EXON

ASAT PRODUCTION SCHEDULE

Senator EXON. General Abrahamson in testimony before our committee, indicated that deployment of a two-layered (SBKKV and ERIS) system could begin in 1994. You have testified that the ERIS would not be available until "five years" after the IOC of the Air Force MHV ASAT. Yet your planning documents show delivery of only [deleted]. Please explain the apparent contradiction between dates and your assertion of a "five year" gap.

General RANKINE. There is no contradiction. We have stated that the gap is [deleted] and is the difference in Initial Operational Capability (IOC) dates between the Air-Launched Miniature Vehicle (ALMV) and an ASAT ERIS. The currently projected IOC for the ALMV is [deleted] and consists of a force structure of [deleted]. If an ASAT ERIS were to be started in fiscal year 1988 and had no testing, deployment, or funding constraints, it could achieve an [deleted].

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

CONSTRAINED ASAT OPERATIONAL CAPABILITY

Senator THURMOND. General Rankine, when could an operational MHV ASAT capability be available assuming the budget constrained funding profile in the President's budget? When could an analogous operational ERIS ASAT capability be available assuming comparable budget constraints.

General RANKINE. Since the SDIO budget does not now provide for an ASAT version of ERIS, no meaningful estimate of a "budget constrained" ERIS ASAT can be made. Assuming the funding levels requested in the fiscal year 1988/89 President's budget and contained within the DOD Five Year Defense Plan, [deleted].

UNCONSTRAINED ASAT OPERATIONAL CAPABILITY

Senator THURMOND. When could an operational MHV ASAT capability be available if technology was the only constraint, that is, adequate funding and freedom to test were provided? When could an analogous operational ERIS ASAT capability be available assuming only technology constraints, that is, adequate funding and no testing constraints on ERIS development and deployment.

General RANKINE. Assuming a start in fiscal year 1988 and no testing, deployment, or funding constraints, the following operational capability dates could be achieved:

System	Initial operational capability	Final operational capability
Air-launched ASAT ERIS	[Deleted]	[Deleted.]

COST OF MHV ASAT VERSUS ERIS ASAT

Senator THURMOND. What is the estimated cost of completing the MHV ASAT program compared to the estimated additional cost of developing an ERIS ASAT capability, and procuring a comparable number of operational and test units. How much has already been expended on the MHV program?

General RANKINE. The estimated cost of completing the air-launched ASAT program is $2,452.6 million. This will procure a [deleted] force structure. Including fiscal year 1987 funds, $1,558.3 million has already been expended. We have not done a detailed cost estimate of developing an ERIS ASAT since it will depend heavily on the assumptions used. For example, items such as phasing of the ASAT capability into the ERIS ballistic missile defense program, the deployment/basing concept, the operational need dates, the total number of missiles to be procured (ratio of ballistic missile defense versions to ASAT versions), etc., all need to be defined to provide a cost estimate in which we would have any confidence. If desired we will work with members of your staff to start such an effort.

ASAT INVESTMENT COSTS

Senator THURMOND. What investment has already been made in the development of the supporting equipments and software required to test and eventually support an operational ASAT deployment, and how much of this investment would be applicable to support an ERIS ASAT development and deployment?

General RANKINE. Including fiscal year 1987, $1,426.1 million of Research, Development, Test & Evaluation (RDT&E) funds have been expended for the air-launched ASAT program. We estimate that an additional $902.2 million of RDT&E funding is required to complete the development and testing efforts. There has been no detailed assessment completed to determine the applicability of the current air-launched ASAT investment to development and deployment of an ERIS ASAT. However, based on a quick evaluation, we believe that because of the different technology and design, there would be minimal overlap with one exception. The major area of applicability would be in the [deleted]. Currently, these activities are being performed by the Prototype Mission Operations Center (PMOC) in the Cheyenne Mountain Complex at Colorado Springs, CO. The total investment to date in the PMOC development, equipment, software, and operations is $59 million.

ARMS CONTROL IMPLICATIONS FOR ASAT

Senator THURMOND. What are the arms control implications of developing and testing a system in an ASAT mode that is also to be tested in an ABM mode in accordance with ABM Treaty provisions? Would not the deployment of such an ASAT system be constrained by the provisions of the ABM Treaty?

General RANKINE. Systems designed for ASAT missions are not constrained by the 1972 ABM Treaty. There are no plans to test the current air-launch ASAT system in an ABM mode. If, however, such a system was tested in an ABM mode, it would be subject to ABM Treaty restrictions.

PRIORITY OF ASAT REQUIREMENTS

Senator THURMOND. General Piotrowski, the ASAT program seems to satisfy both a deterrence requirement and a warfighting requirement. Do you attach more priority to one or the other of these functions?

General PIOTROWSKI. Deterrent and warfighting capabilities are both vital and interrelated. The deterrent value of weapons systems springs from their effectiveness in and contributions to warfighting. A United States ASAT program would satisfy both a deterrence and a warfighting requirement.

Deterrence can be viewed in both a broad and a narrow sense. In the narrow sense, an operational United States ASAT would deter the Soviets from using their already operational and very capable co-orbital interceptor, GALOSH antiballistic missile, or Sary Shagan laser against our space assets. In a time of crisis, and knowing that the United States could not retaliate with a response-in-kind, the Soviets might not be deterred from attacking our satellites. We would then be faced with the options of not responding, or of responding in some way that might escalate the crisis. An operational United States ASAT, however, could deter the Soviets from employing their own ASAT systems. In the broad sense, a United States ASAT would contribute to that full range of capabilities that deter major conflict.

Moreover, should deterrence fail, the United States ASAT could be employed against those Soviet systems that locate and target friendly forces. Denied the tracking and targeting information provided by their space force structure, Soviet naval,

air and land forces would be much less effective in countering U.S. and allied operations.

ASAT SUPPORT FUNCTIONS CAPABILITIES

Senator THURMOND. Could the support functions that are in place at Space Command for the ASAT test program support an operational ASAT launch in a crisis if so ordered by the President?

General PIOTROWSKI. If directed by the President, we could respond with a very limited capability using research and development assets only. We are working to have such a capability in place by the end of this year. At that time, we will have between [deleted]. However, resumption of testing and full funding of the air-launched ASAT program are essential to the development and deployment of a system in which we would have high confidence in combat. In the interim, the R&D assets could provide a very limited capability for deterrence or for use in a crisis.

ASAT TESTING

Senator THURMOND. As the operational commander, what importance do you attach to ASAT testing? If the Soviets were to destroy one of our satellites, what confidence would you have that the miniature homing vehicle ASAT without further development testing could retaliate in kind?

General PIOTROWSKI. The programmatic testing cycle is very critical to any weapons system development. The successful ASAT intercept test of September 13, 1985 gave us a clear indication that the MHV design is sound and the test program properly structured; and if pursued would lead to the deployment of a system in which we have high confidence. However, one successful test in a highly structured R&D environment does not make an operational weapon. We need to continue our programmed end-to-end test schedule to build full confidence in the system. Continued intercept testing will confirm performance characteristics throughout the ASAT flight envelope. My confidence in the ASAT as an operational system is directly tied to the success or failure of the system throughout the testing program.

ASAT EFFECTIVENESS

Senator THURMOND. What is your assessment of the military effectiveness of the miniature homing vehicle ASAT as currently designed? What urgency do you attach to research efforts to increase the altitude capability?

General PIOTROWSKI. The military effectiveness of the Miniature Vehicle ASAT cannot be determined with high confidence without completing the test program. I suspect, however, that the Miniature Vehicle ASAT would prove to be very effective against the threat it is intended to put at risk. However, that threat is evolving. [Deleted.] There is a military requirement to put those systems at risk today. Research efforts to increase ASAT altitude capability should be urgently pursued.

STRATEGY FOR SDI/ASAT

Senator THURMOND. What is your overall assessment of a strategy that waits for the SDI program to satisfy our ASAT requirements?

General PIOTROWSKI. I strongly support the research and technology efforts being pursued under the SDI program, however, one must recognize that this Ballistic Missile Defense effort is separate and distinct from the Space Control ASAT program in mission, scope, and capabilities. We must resume testing and deploy an operational ASAT as soon as possible. Continuous evaluation of the SDI effort may produce by-products complementary to our ASAT capability. However, we need an ASAT capability now to counter the existing Soviet threat, and cannot wait for capabilities that may result from SDI research. The SDI approach runs the risk of pushing downstream by another decade or more a national ASAT capability—the cornerstone of my Space Control mission.

Senator EXON. We are now adjourned.

[Whereupon, at 10:40 a.m., the subcommittee was adjourned.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

TUESDAY, MARCH 31, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

DEPARTMENT OF ENERGY'S BUDGET

The subcommittee met in executive session, pursuant to notice, at 9:08 a.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Thurmond, and Warner.

Staff present: Arnold L. Punaro, staff director; Robert F. Bott, William E. Hoehn, Jr., professional staff members; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Edward M. McGaffigan, Jr., assistant to Senator Bingaman; Donald A. Mitchell, assistant to Senator Glenn; William J. Wight, assistant to Senator Warner; Henry D. Sokolski, assistant to Senator Quayle; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order.

This morning, the Subcommittee on Strategic Forces and Nuclear Deterrence meets for its 15th scheduled hearing, to receive testimony on the military application portion of the Department of Energy's budget request for fiscal years 1988 and 1989.

Our two witnesses this morning are the Hon. Sylvester Foley, Assistant Secretary for Defense Programs and the Department of Energy's representative on the Nuclear Weapons Council; and the Hon. Robert Barker, who is the Assistant to the Secretary of Defense for Atomic Energy and the staff director of the Nuclear Weapons Council.

Welcome to both of you gentlemen. I would like to add at this time that all of the written statements that are submitted by the witnesses today will be included in the record, without objection.

I have asked that our witnesses cover two topics beyond the basics of the DOE budget request. The first topic is to update the subcommittee on the progress of the new Nuclear Weapons Council

since its creation in last year's authorization act. We would like to know how that is coming.

The second topic is to give the subcommittee some better insight into the magnitude of the potential costs associated with the modernization and refurbishment of the production facilities, including reducing the fragility of that system, and, second, the magnitude of the potential costs associated with meeting environmental, health, and safety standards across those facilities.

I have a suspicion that we will find those sums to be breathtakingly large, especially given the strength of the budget that most of the committees of the Congress currently are wrestling with.

We have a number of important subjects that we must address. So, without further ado, let me go right to the witnesses, and at an appropriate break in the proceedings this morning, I will ask my colleague, the distinguished Senator from South Carolina, the ranking member of this subcommittee, to make any opening remarks that he thinks are appropriate. Without objection, the remarks that will be given later by Senator Thurmond will be introduced and printed in the record immediately following the remarks of the chairman.

[The opening statement of Senator Thurmond follows:]

OPENING STATEMENT BY SENATOR STROM THURMOND

Thank you, Mr. Chairman. I join with you in welcoming our witnesses back to the subcommittee to testify in support of the Department of Energy's budget request for Defense Programs. We respect very much the experience and understanding of nuclear weapons issues that Dr. Barker and Admiral Foley possess, and assure them that their testimony will weigh heavily on our budget deliberations.

Mr. Chairman, this has not been a good year for the nuclear weapons program. The accident at Chernobyl, which I am sure has not curtailed Soviet nuclear weapons production, has focused attention on the fragile U.S. weapons production complex. While I take no issue with the actions that have been taken at the Hanford Complex, and at Savannah River, the fact remains that the production of critical nuclear material has been slowed considerably. This has been aggravated by the unexpected shutdown of a Savannah River reactor that may be beyond repair.

There are those in the Congress who argue that we should make do with the nuclear material already produced and make no investments in new production. I find this to be a totally unacceptable position and one that ignores the nuclear material needs of the weapons that are already deployed. So long as we depend on nuclear weapons for deterrence, we will need to provide an assured source of critical nuclear material, just as we will need to be able to test.

In view of this situation, the budget before us is a disappointment to me in that it does not provide for replacement reactors. I have written to Secretary Herrington about my concern for the future availability of critical nuclear material, and have encouraged him to take early action on a new production reactor. It is my hope that the subcommittee will see fit to take an initiative on this issue.

Mr. Chairman, as Admiral Foley's statement indicates, the current budget environment makes it very difficult to satisfy the requirements of the Department of Defense while at the same time maintaining a core technology program and a fragile production complex with increasing overhead for security and environmental remedies. I commend the Admiral for the program analysis and strategic planning initiatives that he has taken in an attempt to balance these competing priorities for the future. This Committee will be most interested in the results of these analysis efforts.

Gentlemen, I look forward to your testimony.

Thank you, Mr. Chairman.

Senator EXON. With that, Admiral Foley, we will go right to you. I guess that you will be proceeding first. Is that the way you would prefer it?

Admiral FOLEY. Yes, sir.

Senator EXON. Then we will go to our second witness after your presentation.

Welcome to you, and please proceed.

I will just simply announce that, as is obvious, we are in secret classification this morning. The microphones therefore are not in use. So please speak loudly, and proceed.

STATEMENT OF HON. SYLVESTER R. FOLEY, JR., ASSISTANT SECRETARY FOR DEFENSE PROGRAMS, DEPARTMENT OF ENERGY

Admiral FOLEY. Thank you very much, Mr. Chairman.

With the inclusion of the statements of my Deputy Assistant Secretaries, sir, I will proceed with some viewgraphs and address the other two specific issues that you have passed to us, sir.

DOE PRESENTATION OVERVIEW

OUTLINE

I.	Mission Responsibilities/Priorities
II.	Major Accomplishments
III.	Challenges/Issues
IV.	Budget Summary
V.	Conclusion

This is the outline of what I will talk about: our mission accomplishments and responsibilities, some of the accomplishments of the past year, and what challenges are facing us. We will talk about the budget that we submitted, and then I will conclude.

DEFENSE PROGRAMS' MISSIONS

- SUPPORT NUCLEAR DETERRENT
  - CONDUCT RESEARCH AND DEVELOPMENT
  - PRODUCE AND MAINTAIN NUCLEAR WEAPONS AND NUCLEAR MATERIALS, AND PROCESS GENERATED WASTE
  - ASSESS FOREIGN CAPABILITIES AND COMPLIANCE WITH TREATIES
- PROVIDE SAFEGUARDS AND SECURITY FOR NUCLEAR WEAPONS, MATERIALS, AND FACILITIES
  - ASSURE SAFE AND SECURE OPERATIONS OF DOE FACILITIES AND MATERIALS
  - PROVIDE CLASSIFICATION AND CONTROL OF NUCLEAR WEAPONS INFORMATION AND EXCHANGE OF TECHNOLOGY
  - PROVIDE INDEPENDENT ASSURANCE OF EFFECTIVE POLICY AND PROTECTIVE MEASURES
- PROVIDE SAFE AND ENVIRONMENTALLY ACCEPTABLE OPERATIONS OF DEFENSE PROGRAM FACILITIES

First of all, the missions are, quite briefly, to support the nuclear deterrent, conduct research and development, produce nuclear weapons and materials, produce them in a safe and secure manner, make sure that we do this in an environmentally acceptable manner, and then proceed to other issues which are rather ancillary to this.

DEFENSE PROGRAMS' PRIORITIES

- o MAINTAIN BASIC CAPABILITY & CAPACITY
  - FACILITIES (WITH CONTINUED RESTORATION, REVITALIZATION, AND MAINTENANCE)
  - RD&T TECH BASE
  - ESSENTIAL SAFEGUARDS AND SECURITY
  - CONTINUITY OF OPERATIONS - ES&H
- o SUPPORT NWSM REQUIREMENTS
  - WEAPONS DEVELOPMENT AND PRODUCTION
  - NUCLEAR MATERIALS AVAILABILITY
  - SUPPORT ACTIVITIES
- o STRATEGIC DEFENSE INITIATIVE MILESTONES
- o IMPROVEMENT EFFORTS

The priorities, first and foremost, across the board, are to maintain the basic capability.

CHALLENGES

You already mentioned in your opening statement, sir, about the fragility of the entire complex. My No. 1 responsibility is to see if we can make the complex a bit more robust; to see if we can buttress it up just a little bit; to see if we can get a little more redundancy, because we have too much that is one of a kind and too much of an aging complex out there.

Now, for the technology base, the laboratory directors are lined up in a solid phalanx to say we cannot reduce the technology base any more. Well, that is pretty easy to say, but when you start compressing budgets, the technology base is going to take a hit just like everything else does.

On safeguards and security, defense programs is spending about $700 million a year. We are a lot safer than we were 1, 2, or 3 years ago and a lot more secure from any adversary, terrorist, or anyone attempting to come in and disrupt our production or in any way try to take away some of the materials.

On environment, safety, and health, you addressed the issue and asked what is it going to cost us. I will get to that as we move into the complex itself. But we are spending about $740 million a year for environment, safety, and health activities. This is just a drop in the bucket. This is what we have identified as we go along.

But the Department, under the direction of Assistant Secretary Mary Walker, has been charged by Secretary Herrington to go throughout the entire complex and prioritize what needs to be done, where it needs to be done, and then get an aggregate of how much it is going to cost. It will cost billions of dollars.

You cannot take this out of our existing program. You cannot take it out of our hide. The numbers are just too great.

So, this remains a challenge which is going to continue for the next few years.

A year and a half ago, our stockpile requirements for weapons development and production of nuclear materials was much better than it is right now.

Presently, one of our principal production reactors, our N Reactor at Hanford, is being refurbished over a 6-month period. Safety enhancements are being installed. We have throttled back to the 50 percent level at the Savannah River production reactors. [Deleted.]

Another continuing research and development issue for us is the Strategic Defense Initiative.

Senator EXON. Let me interrupt you there for just a minute, Admiral Foley. We suspected that for a long time. You are going to get into how we are going to correct that later, aren't you?

Admiral FOLEY. Yes, sir.

But I'll tell you, first of all, it is not going to be a short-term correction or a short-term fix. It is going to be a number of things. It will not be any single cure-all, and it will be costly. But I will get to these.

STRATEGIC DEFENSE INITIATIVE

On the Strategic Defense Initiative, we have, in fiscal year 1987, about $317 million. In fiscal year 1988, we are talking in the neighborhood of about $500 million. It must continue out through the early 1990s at approximately this level of funding if we are going to meet the milestone requirements of General Abrahamson and the Department of Defense.

As for improvement efforts, I lump those into all of the things that we are doing in defense programs in terms of long-range planning, in terms of personnel movement, and tightening up the system.

WEAPONS DEVELOPMENT, TESTING AND PRODUCTION AND NUCLEAR MATERIALS SITES

8(a)

Again, just to refresh your memory, this is a national effort that we have here. I can address this a little better on my feet using the pointer. I will point out right away that Savannah River is one of the strong points in our entire complex.

As the Senator knows, we have throttled back about 50 percent on the production reactors, and this situation is one that we are going to have to watch very carefully. Looking at the entire complex—all things there depend on each other. One particular facility is linked to another and not one stands alone.

MAJOR ACCOMPLISHMENTS

As for our major accomplishments——

Management Initiatives

Senior Management Planning Council Formed to Address:
- — Strategic issues analyses, and
- — Five year program analyses

Leading to "Corporate" approved program

These are the things over the past year I will report to the Board of Directors and to all of you. First of all, we have a Five Year Program Analysis which is very similar to what the Department of Defense does in its Five Year Defense Program. We have developed this Five Year Program Analysis to try to keep the program balanced so that we don't just use the budget as a planning tool.

Then we move out to a strategic issues analysis. This is the long-range plan: what do you want the complex to look like after the year 2000, out to 2005, or 2010?

You may not be able to reach all of this because the budget may not permit it. But you want to make conscious decisions when you take away from your planning in order to meet the budget, and know what the impact is. Then a "corporate" approved program will bring all the laboratory directors and field managers in and sit them down around the table, just as you are here. That is my "corporate" board. We work out the problems in a collegial fashion. We do that with the budget.

They don't go home satisfied, necessarily, but they have all played in the process, and that is important.

IMPLEMENTATION OF BLUE RIBBON TASK GROUP RECOMMENDATIONS

Actions taken—
NUCLEAR WEAPONS COUNCIL CREATED
INCREASED EMPHASIS BEING PLACED UPON WEAPON SYSTEMS TRADEOFF ANALYSES
PROCEDURES ESTABLISHED FOR ANNUAL SUBMISSION OF DOE DECISION COSTS TO DOD AS PART OF PPBS PROCESS
MOU SIGNED WHICH FACILITATES IMPROVED CONVENTIONAL MUNITIONS WORK AT NATIONAL LABORATORIES
Full report to Congress on BRTG recommendations

As for the Blue Ribbon Task Group, it had its origins here. Its recommendations have now been implemented. I will give you a little report on how we are doing on that. Specifically, the Nuclear Weapons Council was created. We had our first meeting in early February: Mr. Godwin, Dr. Barker, the Vice Director of the Joint Chiefs of Staff, General Herres, and myself.

I am encouraged. I like what I see. I think you have the opportunity there. It has a middle level decisionmaking body, short of having to go up to the Secretaries.

I have seen Mr. Godwin, with every intention of making priority decisions and prioritization that I think was impossible to do in the past. So I think it looks pretty good to me so far.

The procedures are established for how we are going to operate. We have memoranda of understanding assigned with the laboratories about how we are going to work the conventional munitions so that the synergism between the nuclear and the convention munitions can be worked out at the laboratories.

We have smart, able people out there, and we will respond to the requirements of the Department of Defense.

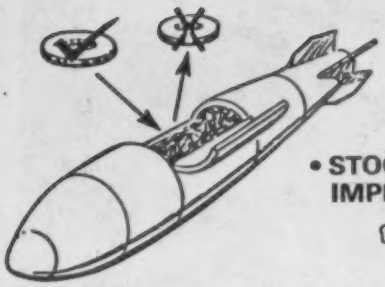
Last year, we contributed about $12 million and so did Defense. This year, we have $15 million in our budget and Defense does also. Anything above that will be work for others to pay for. But we have $30 million worth of conventional weapons work going on at those laboratories, and I think that is a strong plus.

PROGRAMMATIC ACCOMPLISHMENTS

The full report to the Congress on all of these was signed out by Secretary Herrington last night, and we have an advance copy that we have provided for the staff. It should be delivered sometime today.

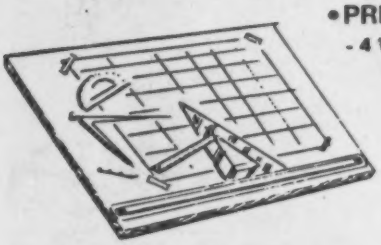
STOCKPILE ASSETS

FY 1986 PRODUCTION ACCOMPLISHMENTS



- NEW DELIVERIES
  [DELETED]
  - 10 SYSTEMS
- STOCKPILE IMPROVEMENT
  [DELETED]

- PRE PRODUCTION
  - 4 WEAPONS SYSTEMS



- RETIREMENTS
  [DELETED]

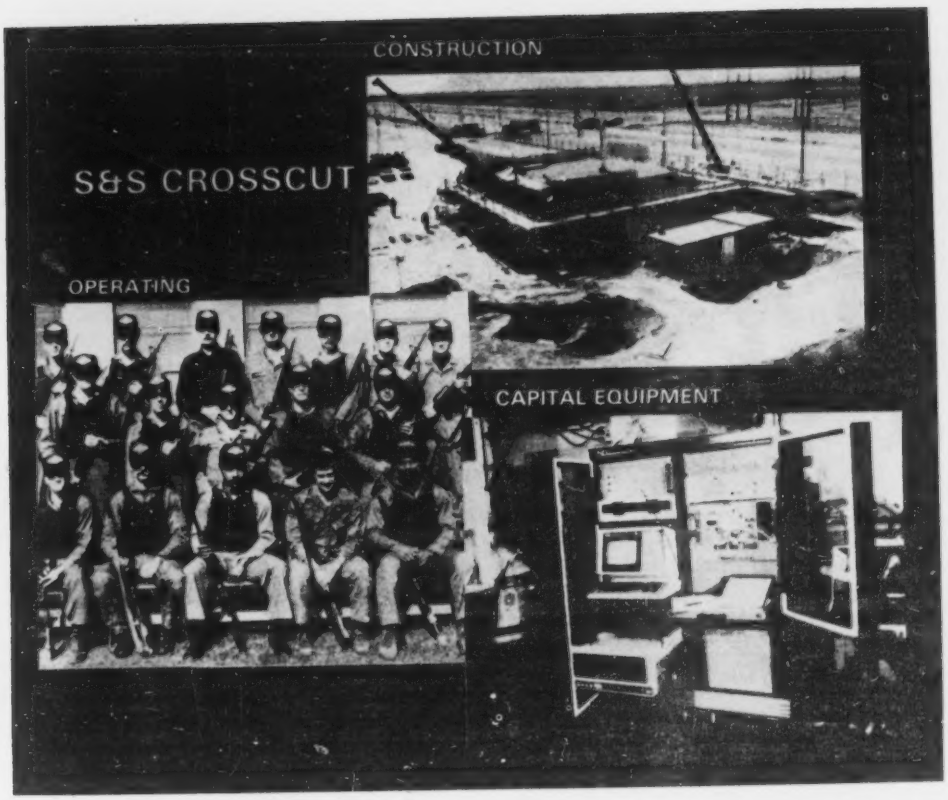
Now, within the programs, what have we done in the last year?

The first thing is that we have new deliveries, [deleted] for 10 different systems, [deleted]. We hang in there. We meet the requirements, but we get [deleted] the material of our weapons coming from new production materials and [deleted] of it comes out of retirements. We spread this over a 10-year period.

So, we are getting most of the material from the retirements. We mine these weapon retirements as they are turned in.

There are also stockpile improvements and safety fixes, the things that we need to put into weapons. There are [deleted] weapons that had these put in. The four weapons systems that we are currently working on are the Trident II, the small ICBM, the SRAM II, and the nuclear depth strike bomb.

All of these are Phase IIA and Phase III that we are putting into our test program.



This is just a quick look at some of the accomplishments that are not only in hardware but in our operating forces down here (indicating).

SAFEGUARDS AND SECURITY

A few years ago, we had 3,000 people in our safeguards and security protective force. Now we have about 6,000. We had a court case in our favor yesterday, in an appeals court in California. It said yes, you can hold them to strong, stringent physical standards.

So our guards are professionally trained. They are very able. They meet physical requirements, and they are a very professional guard force of about 6,000 throughout the country.

As for construction, we are upgrading——

Senator EXON. There are 6,000 guards across the country for your program—is that what you are telling us?

Admiral FOLEY. Yes, sir.

Senator EXON. You are beginning to startle us with some facts. I suspect there is more to come when we get into the money part of it. But I am glad that you have that kind of system, and I am glad you have the court decision that allows you to hire people to certain specifications.

I was surprised when you said 6,000. Of course, that is 24 hours a day, around the clock?

Admiral FOLEY. Yes, 24 hours a day, around the clock.

Senator EXON. Just to give me an idea, what percentage of those are on duty at one time?

Admiral FOLEY. A ballpark figure is about one-third.

Senator EXON. A third. It is three 8-hour shifts, then.

Admiral FOLEY. Yes, sir.

Of course, some are at school, some are off duty, some are on leave, on vacation, that sort of thing. But the ballpark is about a third of them, and I might say that we have a very professional force. You will find them impressive.

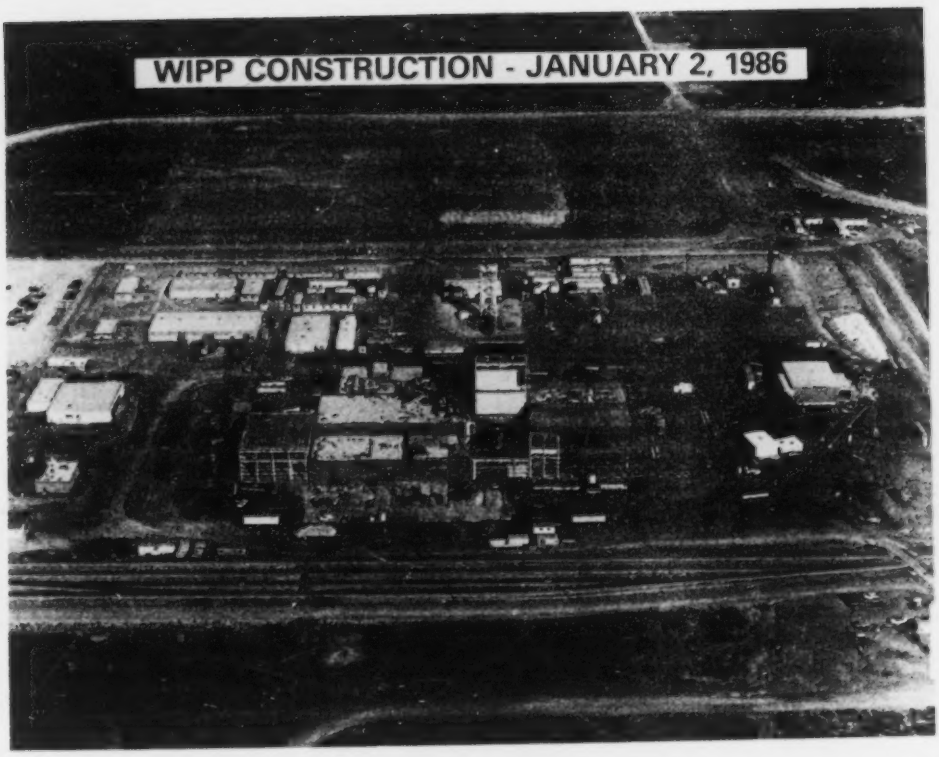
We have large geographic areas, in Idaho, for example, or down in Savannah River, where we have hundreds of square miles. We have about 800 guards in Savannah River.

But this is not the old night watchman that you have seen in some places, perhaps at a warehouse. Most of these, I believe, are former military people. Many of them have been in special forces or in security work in the Armed Forces. They are very skilled, have a very high morale, and a lot of esprit-de-corps. This is a class organization that we have here.

There are facilities being replaced.

Down here, you can see that we are monitoring equipment. We use computers for it. This is just to give you a feeling that across the board we are upgrading.

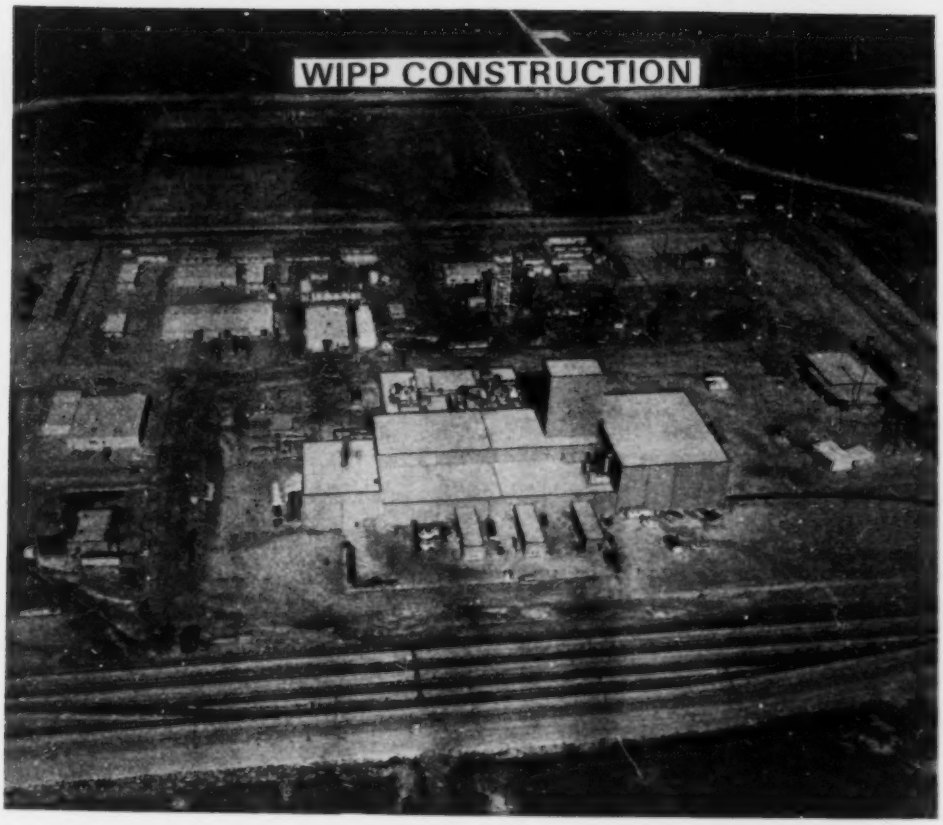
The inspection and evaluations team that I have reports to me. I send them out on inspections to different places. They say it is getting much tougher to break-in or simulate breaking in or trying to get hold of something or making contact with an insider. That is good news because it means that we are becoming much more professional. We are closing all of the loopholes that we might have had in our security.



WASTE MANAGEMENT

Let's take a quick peek at the WIPP construction near Carlsbad, NM. This was last year.

You will notice this area, down in here (indicating), which is all pretty open and still being worked on.



This year, you can see that we are much further along (indicating). This facility is due to open in about a year. It is moving along rapidly and right on schedule and on cost.

This is the Defense Waste Processing Facility at Savannah River. It is about 50 percent completed right now. It should cost about $900-plus million, just under $1 billion, and we have been holding that down. It is proceeding along well.

We have a similar plant that we are planning to construct near Hanford, WA. There is money in the budget this year for the early design portions of that plant. The Defense Waste Processing Facility at Savannah River is moving along quite well. We are about at the stage where we are starting to put money in to change it from a construction phase to an operating facility.

Senator EXON. What will that facility there be used for, for example?

Admiral FOLEY. It will take the high-level waste that we have and vitrify it.

Senator EXON. And you will put it where?

Admiral FOLEY. We will make glass logs out of that, surrounded by stainless steel, and put them down here temporarily. Then, when you decide where your repository is going to be in the United States, we will place them there.

Senator EXON. Now that is where?

Admiral FOLEY. That is in Savannah River, sir.

WASTE ISOLATION PILOT PLANT

Senator EXON. What about the facility that you had, the one in New Mexico, I believe? What about that facility.

Admiral FOLEY. Let me go back to the previous slide.

[Slide deleted.]

This is the one in New Mexico, the Waste Isolation Pilot Plant, which is just outside of Carlsbad, NM. What you have inside this building right here (indicating) is an elevator shaft. It goes down about 2,000 feet. You have 10 or 15 miles of tunnels in there, in salt formation, where we will put the transuranic waste, what I call the middle-grade waste. There are three levels of waste: low-level, transuranic, and high-level.

The transuranic waste, which we will take from different places around the country, will be shipped, hopefully, by rail and by truck to here, and it will go down these elevators, and tucked away in there, down about 2,000 feet in Carlsbad.

We have a very supportive community out there, and this is moving along well. It is on schedule.

The price has held constant over the last few years.

This is a model facility.

Senator EXON. Thank you. I am sorry to interrupt you, but I just wanted to be sure that I understood you.

Admiral FOLEY. The commitment for this is to dispose of the transuranic military waste, not the high-level waste.

Senator EXON. I understand that it is going to cost as much or more to dispose of this waste product as it is to produce the product itself, is that about right?

Admiral FOLEY. My guess, quite candidly, is that it is going to cost more to get rid of the waste.

Senator EXON. More than the production?

Admiral FOLEY. Yes, because the problem we have is that there is a lot of cleanup and past insults to the environment that have to be taken care of.

It is those 40 years' worth of cleanup and taking care of ponds and all of these other things that is going to cost the big money.

Senator EXON. Now, is this for military, U.S. Government ordered and produced military waste only, or will there be other waste storage disposed of in this fashion through this facility?

Admiral FOLEY. This is military only.

Senator EXON. What about some of the other sites? They are mixed, aren't they?

Admiral FOLEY. Yes, sir. I will let Dr. Barker address the issue of the Department of Defense wastes as they come up, sir.

Right now, all we are really talking about here is ours. You have to remember that we produce the weapons. What we give to the Department of Defense is the finished product. We give them the bombs, and they handle them.

So, any environmental cleanup that they have really is not of this nature. It is not a radioactive cleanup. That belongs to the Department of Energy.

They have waste cleanup. But it is low-level—the kind of things that come out of a hospital ward and things like that which you have to put away. They don't have anything of this same type.

Senator THURMOND. Admiral, as I understand this, what you are talking about now is between high-level and low-level waste—is that it?

Admiral FOLEY. Yes, sir. As a nonnuclear physicist, I would categorize them in three categories. The low-level ones are the old

gloves and materials that might come out of hospital wards, glass beakers and things like that, which you can tuck away in low trenches, and there are no great problems at all.

The middle-grade is what they call the transuranic waste, and we have this inside the drums. We have a lot of transuranic waste in Idaho. We also have some in Los Alamos.

This is the transuranic waste that we are going to start putting into this particular facility.

Then there is the high-level, which is the very dangerous kind. That is what we put through your plant down in Savannah River, sir, and in the final analysis, will go into the repository.

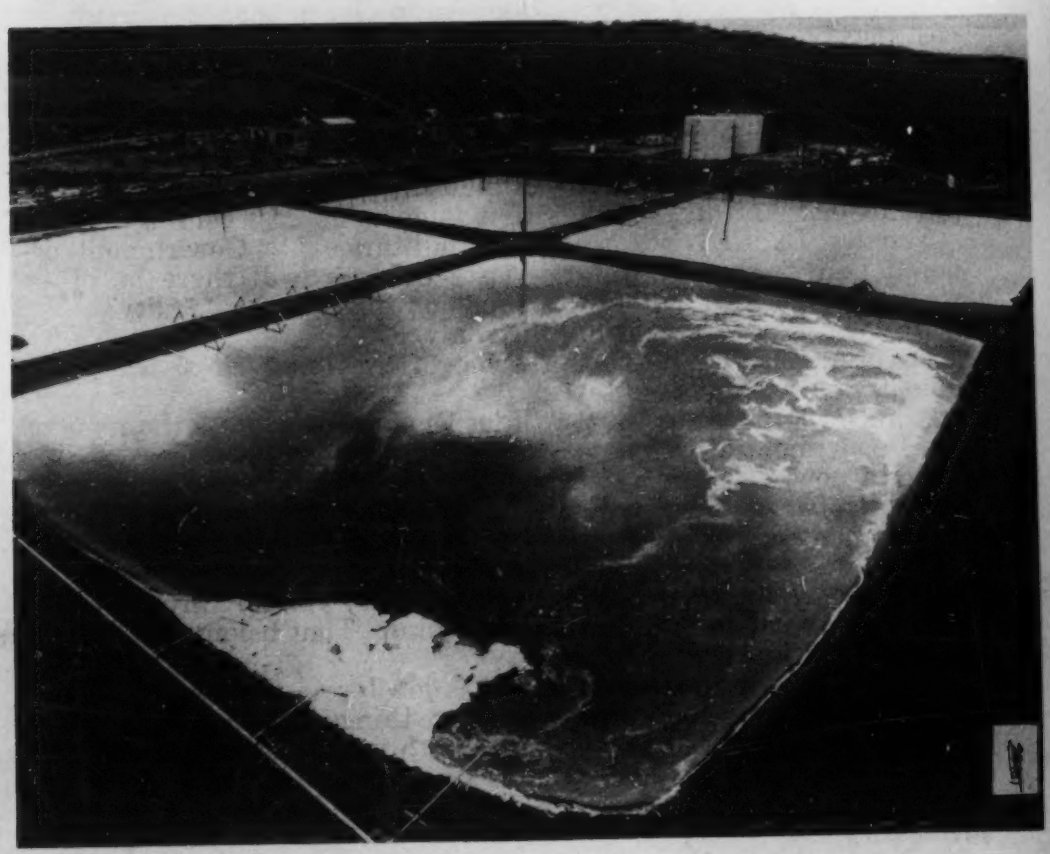
Senator THURMOND. And you glassify that high-level until a permanent place has been determined for its placement?

Admiral FOLEY. Yes, sir. Exactly.

We glassify or vitrify and surround it with stainless steel so that we can truck it away. We can keep it onsite until the final determination is made as to where that site is going to be, and we will then put it there.

As time goes on, we will develop a vitrification plant in Hanford, WA, clean up there, too, until we are ready to do the same thing with that.

It is part of our overall Defense Waste Management Plan.



IMPROVED WASTE MANAGEMENT TECHNIQUE

This viewgraph shows the old waste ponds at the Y-12 plant in Oak Ridge.

Mr. Chairman, as you have talked about the costs of how we are going to clean these things up in the future, this is an example of what we are planning to do.

This is the way we used to do it.

We used to put the waste in settling ponds and let it settle on down. That is what I call an insult to the environment.

But we are smarter now. We know how to handle things much better now.

So, this is the correction. This is the way we do it today.

Senator EXON. The system that you showed us there a moment ago is not any more than a waste disposal plant that we see all over the country for ordinary waste disposal. At least, that is what it looks like. Did they just dump it in there?

Admiral FOLEY. Do you mean those ponds?

Senator EXON. Yes.

Admiral FOLEY. That is just laying there. We clean up some of the waste, but those are settling ponds. That is all they are. At some places have they leaked? The answer is yes, they have. You have to get out there and clean up a lot of the surrounding area. We are talking big money.

Again, they have to be characterized to determine how much and how far out it goes. That is an ongoing job. It is a tough one.

Senator EXON. In those ponds, would there be only that lowest classification of waste? Or would it get up into that middle classification?

Admiral FOLEY. We have low-level waste there. We don't have any of the higher level.

Senator EXON. How about the medium level? You said there were three levels.

Admiral FOLEY. There are three levels of waste, but in these ponds, it is all low level. There may be some chemicals out there, too. But in terms of what you are talking about, it is low level.

Senator EXON. Nuclear waste—all low-level?

Admiral FOLEY. Yes, sir.

But now here, what you see is state-of-the-art today, for your environmental cleanup.

You do not put the waste into those ponds. You run it through the front end of a facility like this.

We have five of these coming along, so that we are going state-of-the-art. We are cleaning up our act, if you will.

Just to show you the contrast between the old days and the new, you still are committed, but you have to go out and clean up those old ones. That is going to cost you money.

GUNS VERSUS BUTTER

As we go along, I will point out that my environment, safety, and health budget is going up about 10 percent a year. That is a drop in the bucket. It is 10 percent a year right now.

But, when you characterize all of these sites around the country, put them in priority order, and aggregate it all, you are in the billions. You just cannot take that kind of money out of this program and continue to operate it.

We will be forced to come back to the Congress to lay out the extent of this program, which is in the billions of dollars, and we are going to have to take it one bite at a time. It is going to take a couple billion dollars a year to address it adequately.

CHALLENGES/ISSUES

I have already pointed out a few challenges to you as we went along.

I should not say "you." "Us," is a much better term to use because they are not all mine. They are just as much yours as they are mine. But the question is how do we deal with them.

NUCLEAR WEAPONS STOCKPILE REQUIREMENTS WITH AGING FACILITIES

One of these is how do we meet the stockpile requirements of the Department of Defense with these aging facilities? That is one of the challenges that we have as we move along.

[Slide deleted.]

The workload does not go down. We are out here, in fiscal year 1987 now. This is all optimistic when we start talking about deliveries out here (indicating) because the track record is that the

budget will probably be cut to some degree. So this is probably going to be flatter. But the workload is going to stay up there.

The workload is staying up and the deliveries remain fairly flat; however the amount of money in the budget is tailing down a little bit. With the safety and environment issues going up, it does not all fit within the budget.

This is one of the challenges that we have.

[Slide deleted.]

NUCLEAR MATERIALS REQUIREMENTS

Here is the viewgraph that I want to show you which talks about requirements for nuclear materials.

This is used in the Nuclear Weapons Stockpile Memorandum which is signed each year by the President. It is created jointly between the Department of Defense and the Department of Energy. Our people sit down and ask what do we see as the projected weapons needs through the 1990s. Then you back off, work the trade-ins and new weapons that you are going to have, and say how much nuclear material do I need out through these years, so that you can take a look at your facilities. You can see what you have to increase, what you have to replace, and you must have a long-range plan.

That is what this is.

[Deleted.]

You could suggest we retire more weapons. This is a negotiated issue between the Department of Defense and ourselves. They have requirements from unified commanders for the particular weapons, and you do not turn in other than those which, one, have to go in for rework, or, two, those that have been replaced in an orderly fashion by something new coming out.

N REACTOR OPERATIONS

So, what we are looking at here is if the N Reactor continued its active life and then went down in 1994 or sometime out in the mid-1900s, [deleted].

If the N Reactor went down in January 1987, where it is right now, and stayed there, [deleted].

NUCLEAR MATERIALS AVAILABILITY

N Reactor
Savannah River Reactors
New Production Reactor
Special Isotope Separation

When you talk about availability, the N Reactor, which is down now, will hopefully start back up in July. But if you go through a 2-year Environmental Impact Statement requirement or for whatever reason you cannot start it up, [deleted].

If you then take the Savannah River reactors, which are good as gold and continue operating them at 50 percent throttle, [deleted].

NEW PRODUCTION REACTOR

So, the fragility of this complex is coming home to roost. This brings me to my next subject, which is the new production reactor.

I will be coming back to the Congress in fiscal year 1988 and looking for money for a new production reactor. I don't know exactly how much right now, and I don't know exactly what technology because we have asked the National Academy of Sciences and the National Academy of Engineering to take a look at the two new technologies. We have done considerable research on existing heavy water technology. The Department has not made its decision on which one of those to come forward with.

But we need to come forward and start work on a new production reactor to give us a guaranteed supply of tritium.

You need to change tritium in these weapons. It has a half life of 12.5 years.

Senator THURMOND. Admiral, the point you just made, since you have cut back the power of the Savannah River Plant, on account of the danger you feel that might have existed, it is going to be necessary to build a new production reactor to take care of this situation in the long term, isn't it?

Admiral FOLEY. Yes, sir. In my judgment it will.

Senator EXON. Let me ask you another question.

How many lawsuits do you have on your hands right now, Admiral, which are complicating this whole problem?

Admiral FOLEY. For which particular category, sir?

Senator EXON. Just in general. Is it around three or 30?

Admiral FOLEY. I would have to take that for the record because my guess instinctively is that there is a lot of potential legal actions in the environmental area.

We also have them lying in the weeds waiting. As soon as we try to start up a reactor, they are going to come back at us with specific lawsuits aimed at shutting us down and keeping us closed down.

[The information follows:]

LAWSUITS PENDING

At present, there are no lawsuits pending concerning DOE production reactor operations. However, DOE is responding to environmental lawsuits at the Savannah River Plant in South Carolina and the Feed Materials Production Center in Ohio. DOE is also actively working on more than twenty potential legal challenges across the nuclear materials/weapons complex concerning various environmental issues.

N REACTOR USEFUL LIFE

Senator EXON. What about the N Reactor, the first item up there, because that is a very troublesome one, is it not?

Admiral FOLEY. Yes, sir, it is troublesome. Let me give you just a little bit of history on it.

When I came in a year and a half ago, there was a gameplan which said the N Reactor could not have its life extended past the year 2000. We would replace the graphite moderator in it and shave it or replace it in some way.

After Chernobyl, we went back and took a careful look at our own in-house safety analysis, as well as the National Academy of Sciences and the panel headed up by Dr. Roddis. There were six experts selected by the Department, and we asked them to take a look.

With two exceptions they all came back and said that the N Reactor was OK. It was safe to run it now, but you should not plan to

run it any longer than the time that the current graphite moderator reaches the top of the structure. When it reaches the top, that is the end. That is the cut sign, the end of the life cycle of the N Reactor.

That is early in the mid-1990s.

As a result, we have backed off from past the year 2000 into the 1990s. You have already seen that if we don't have the N Reactor [deleted].

So, what I am saying is that we need to start up the N Reactor in July of this year. We closed it down in January for 6 months for routine maintenance and to put in some safety enhancements.

These enhancements widen the margin of safety for this operation. We are convinced that it is safe to operate. I think it is in the neighborhood of 48 out of 50 experts that we have had look at it who said yes, it is safe to operate this if you have a need for the special nuclear materials; and we do have a need.

But we want to widen that margin. So we are putting in some safety enhancements in the N Reactor that will, hopefully, permit us to start this up around the July timeframe.

If we cannot start it up then, we have to go through a full Environmental Impact Statement, stretching out a couple of years. We would have to take a good, careful look and say, does it make any sense, really, to start the thing up at all. Is it cost effective to put money into starting it up at all? Or should you grit your teeth, see what you can do [deleted] and start on a new production reactor just as quickly as you possibly can for a tritium producer, so that you can turn everything else on for plutonium.

I must say that situations at Savannah River and the N Reactor have driven me to this position of the new production reactor. In addition, we are looking at the special isotope separation process, which may be sited in Idaho.

We are just working on it, but this is independent of the production reactor. It will enable us to extract a supply of plutonium, of special nuclear material already out there, so that we have another source of material that we could use for our weapons. That would help offset some of these problems that we have up here, with N Reactor and at Savannah River.

So, we are hedging our bets.

We need a new production reactor. We need to keep these going (indicating), as long as we can, and we need to come online with this last process as quickly as possible.

Senator EXON. Thank you.

WEAPONS TESTING

Let me talk about testing. This is an issue that will be before the Senate as well as the House, and in short order.

[Slide deleted.]

I will show this slide because people talk about our testing but they often don't know anything about the Soviet testing.

This shows all the tests that the United States has conducted since 1976 and all of the Soviet tests that have been detected by us. We have thrown out any Soviet tests that were controversial or that we were not sure of.

These are the numbers of United States tests and Soviet tests over the past 10 years—[deleted.] In recent years, they have tested more than we have.

All of these, with the diagonal lines areas (indicating), right up until the time that they went into a moratorium in 1985, show that they tested more than we did, even in 1985.

So, 1986 is the only time that we are clearly well out in front.

There are other areas over here (indicating), where it is close, early-on. But the Soviets have tested more than we have.

Senator EXON. You say the Soviets have tested more than we have. But from that period, 1980 through 1986, it looked like there were about a third more in those two, like it was about even in 1982, a third or maybe 25 percent more in 1983, and 25 percent more in 1984. Generally speaking, would you say that we have not been too far behind them overall? With the improved techniques that we have for testing, are we about equal during that period on measuring the results of our nuclear inventory?

Admiral FOLEY. I think it is pretty hard to tell, sir.

Senator EXON. Well, I know. But it is a question that keeps coming up all the time. It's said that we are so far behind the Soviets in testing that we do not dare give up testing. We are having a big fight about the 150 kiloton testing level.

When I see a graph like that, I think that maybe we are not so far behind as this Senator was led to believe in testing.

Is that a fair statement? Would you agree with me or not?

Admiral FOLEY. No, I don't agree that we are that "far behind" in testing. We test different kinds of weapons. It's like apples and oranges. Their philosophy is for much larger ones with much heavier throw-weights, [deleted]. We are not getting into compartmented information here today, so let's just say that they test as much as they believe they need to test.

We think they probably have reached a plateau, where they had completed a series of tests before they went to their moratorium.

Senator EXON. I agree.

Admiral FOLEY. I will also tell you that the military people who agreed to accede to that moratorium had no idea that it was going to extend for as long as it did. It extended on that long for political purposes, not military. I'll bet they were fussing and hollering all the way along, and they started back up again because there was a need to do it.

But in our case, we design differently. We try to minimize the amount of nuclear material. We try to make weapons as small and safe as we can; therefore, they become much more technologically sophisticated.

It is a tougher problem, and since it is a tougher problem, you need to test more.

[Slide deleted.]

TESTING LOCATIONS

Now, where are we testing?

Here, in the United States, it is easy, Mr. Chairman. You go out to the Nevada Test Site and that is where we do it all. But this is not so in the Soviet Union.

So, when you want to talk about monitoring or covering what they are doing in the Soviet Union, you have a more difficult problem.

They test today principally down here at Semipalatinsk, and up in Novaya Zemlya. Obviously, they do not do it up here in the wintertime because it is not fit for man or beast in the wintertime.

So most of the testing is down here (indicating). But if you look around the Soviet Union at what looks like a measles chart, you can see that they have conducted "peaceful" nuclear tests all over the Soviet Union.

When you start talking about monitoring and you start talking about verifying and watching what they are doing, you have your hands full in trying to focus on the different places around the Soviet Union and what kind of test have they done.

Have they used stockpiled weapons in some of these peaceful nuclear tests? The answer is I'll bet they have. [Deleted.]

[Slide deleted.]

TEST SCHEDULE

Our planned DOE testing is shown here.

In 1987, we have [deleted] tests scheduled. I have categorized them roughly in these three different types of categories. The technology base is up here (indicating). This is the basic physics that we need. [Deleted.] We plan to do [deleted]. So far, we have done [deleted].

On weaponization down here (indicating), we have conducted [deleted].

A year ago, Senator Thurmond asked if I would put the Trident II into the stockpile if we could not test it, and I said no, I would not. Well, we are further along now. [Deleted.] So we are moving rapidly along in that.

But these are very necessary to introduce our modern weaponry, into the stockpile.

STRATEGIC DEFENSE INITIATIVE

Let me talk now about SDI.

[Slide deleted.]

"Milestones" is a pretty tough term to use when you are talking about research and development. Maybe it works and maybe it does not, maybe it slips 6 months, and maybe you have a breakthrough because R&D is just that. It is a research project.

[Deleted] but the milestones between 1990 and 1993, as you can see, are shown within a range.

We cannot say this month this will be completed and we will have it (indicating). The two principal areas within defense programs that we are working on are the X-ray laser and hypervelocity pellets.

These two technologies down here (indicating) are barely hanging on by their fingernails in terms of funding. We need about $500 to $600 million a year, continuing out through the 1990s, to try to meet these milestones.

These (indicating) are the two principal technologies, and these (indicating), as I say, are just barely hanging in there.

Senator EXON. Let me ask you a very logical question but I think one that is somewhat practical.

You do not envision—and this is probably more a Defense question than anything else—you do not envision that if all of those systems worked, that we would need all of those systems, do you?

Admiral FOLEY. No, sir.

Senator EXON. So, if one of them works, would that take care of it?

Dr. BARKER. Senator, the President's objective clearly is a nonnuclear strategic defense program. So the baseline U.S. program envisions deploying none of these systems.

The reason for the push at this point is to provide a better understanding of the threat environment which our systems might have to face from the Soviets.

Admiral FOLEY. That's right.

SDI—A CONVENTIONAL PROGRAM

Dr. BARKER. In order to understand which conventional defense technologies can survive in a nuclear environment, one needs to understand this threat.

So that is what the push is for—for all of this.

Admiral FOLEY. If you never heard of SDI, you would still need to do this kind of testing. We would need to know if the Soviets had this kind of capability, then what could they do to our existing systems, what could they do to our offensive capability, and what the damage would be to our current deterrent.

That effort only represents about 10 percent of the entire SDI program.

It is a conventional program. Ninety percent of it is focused on the conventional side and only 10 percent on the DOE side.

But this nuclear work is important because it is front-loaded. You need to find this out first as you move into the other areas.

Dr. BARKER. I do not want to mislead you, Senators, in the sense that if the conventional technologies do not bear fruit and if one is eventually able to prove that one could not find a credible defense with conventional techniques alone, then the country indeed may want to consider whether it wants a defense, albeit one that uses some nuclear capability, or no defense at all. But the current baseline right now is a conventional technology base defense, and the purpose of this is to understand the threat that can be posed to that system.

Senator EXON. So, once again, as you say, it is a research program that you say in your judgment we have to go ahead with——

Admiral FOLEY. Yes, sir.

Senator EXON. To make sure where we are against the Soviets and make certain, if we can, that they would not have a breakthrough that would put us in potential peril? Is that kind of what it comes down to?

Admiral FOLEY. Yes, sir. It sure does.

Dr. BARKER. I would point out that this is nothing new. As long as the Department of Energy laboratories have existed, one of their challenges has been to understand the way in which nuclear technologies may be used for military purposes, either by the United

States or against the United States. We discovered—it must be almost 20 years ago now—that the technology of enhanced radiation, the neutron bomb, was a credible technology. [Deleted] but there is no guarantee that the Soviet Union cannot impose that technology against us, and so we need to understand that kind of threat that can be imposed on us.

It is the same situation here.

Admiral FOLEY. Let me expand a little bit on this viewgraph.

We have the triangles out here, showing scientific demonstration, and here we talk about technical feasibility decisions. This is not strictly correct.

We believe it is technically feasible to do some of these. This timeframe out here is a deployment decision. If all goes well, these technologies will be so robust that I hear you will be able to select one and make the determination to deploy it, if you wanted to do that.

Now, you may not want to do it at all. There is nothing that we have seen so far, coming on out here, that would permit us today, one, to select the technology, or two, to deploy it early in any way at all. You cannot do it.

Senator EXON. What do you think we can do? When do you think we will be in a position to do so, about 1992 or when?

Admiral FOLEY. Somewhere out here in the 1991 or 1992 timeframe, if the funding levels stay, as I say, $500 or $600 million out here into the 1990s.

It may turn out that, as Dr. Barker says, in the last stage of the game you have perfected and matured your conventional capabilities so that you don't need this (indicating). But you know because of this threat assessment what the Soviets could do to you if they had this capability.

That is what is important.

[Slide deleted.]

RESEARCH AND DEVELOPMENT—OVERLAPPING EFFORTS

I will show this viewgraph of overlapping circles, just to point out that research and development activities in the laboratory are not a clear-cut science.

When you take a piece of pie, you cannot cut the laboratories with finite slices because one piece of research development contributes to another.

[Deleted.]

So there is flexibility required in the laboratories out here to conduct this kind of research.

When the Congress puts fences around some of this funding, like inertial confinement fusion, they are putting shackles on the hands of the laboratories. The laboratories need this kind of flexibility.

Senator THURMOND. Would you repeat this statement, please. It is very important.

Admiral FOLEY. Yes, sir.

[Deleted.]

By putting money in there and specifying it just for inertial confinement fusion and putting in another finite amount just for SDI,

the only flexibility you have then in your whole program sits up in the core.

The laboratories need R&D flexibility.

Senator THURMOND. And when they are restricted, they are terribly handicapped, are they not?

Admiral FOLEY. Yes, sir.

I would be remiss if I did not express that view because the laboratory directors feel very, very strongly that they must have that flexibility.

OTHER CHALLENGES/ISSUES

Deciding "how much is enough" for S&S
Increased ES&H funding
Defense waste transition to permanent disposal
Nuclear waste fee

SAFEGUARDS AND SECURITY

This shows other challenges. I have described the challenges, problems, and complaints as we went along. How much is enough for security and safeguards? When are you safe enough?

The Department is putting about $700 million a year into safeguards and security activities. We have about 6,000 guards that I have talked about and all of these other facilities. When does it start tailing down? When have we built enough new guard houses and fences, and trained enough people?

In my judgment, I think we are there. In the past year, we have established standards and criteria and they bump against every one of our facilities. So when a security director says I have to have a new fence 20 feet high with three rolls of barbed wire on it, I can say, wait a minute, that is gold plating, and you don't need it that much.

So I think these will start coming down.

PRODUCTION/ENVIRONMENTAL TRADE-OFFS

An increase in environmental, safety, and health funding is going to happen. There is no question in my mind that the increase is going to continue. The danger is that you reach the point where you cannot take money (or funds) out of the production complex to pay for these, and that is where we are now.

So, I am going to have to go vertical and start shutting things down if I am going to cover the production complex and special nuclear materials and weapons while at the same time fund the environment, safety, and health activities.

This is the point where I said we must come back to you with aggregate numbers. We are going to have to address the overall business of cleanup and safety and health as a specific issue because you cannot take it out of hide any longer.

As for the defense waste transition to permanent disposal, we are in that business. The Defense Waste Processing Facility in Savannah River and the Hanford Waste Vitrification Plant in Richland, WA, are part and parcel of our plan as we move into operation.

We are now handling the low-level waste. We will take the transuranic waste starting next year out to New Mexico. The high-level

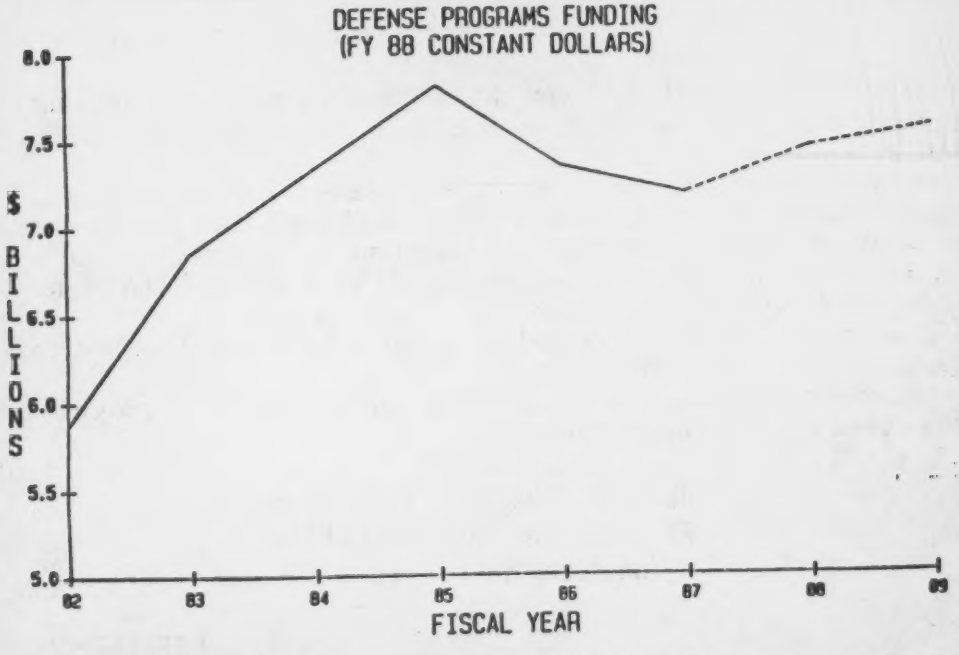
waste that we are putting in glass will be put in the final repository. So we have a good game plan that we are moving along with.

NUCLEAR WASTE FEE

On the nuclear waste fee, I put that up there because I have seen a proposal that Senator Johnston has put forth that talks about giving money to the States where the final repository winds up, taking the money from the nuclear waste fund. We have not put any money into that fund yet. So this is an issue that is going to come up in the future.

BUDGET SUMMARY

Let me summarize the budget.



Here is what it looks like in constant dollars. We are going down. Here we are, in fiscal year 1987.

This is optimistic in fiscal year 1988 and fiscal year 1989. I do not really expect it to go that high. I expect it to flatten out someplace in here (indicating). So I am really saying that there is no growth. If anything, the overall program is going down, because the growth is not occurring on the production side of the house.

DEFENSE PROGRAMS
FY 1988/1989 CONGRESSIONAL REQUEST
(DOLLARS IN MILLIONS)

	FY 86 APPROP	FY 87 APPROP	FY 88 REQUEST	FY 89 REQUEST
WEAPONS ACTIVITIES	$4,177	$4,181	$4,535	$4,606
NUCLEAR MATERIALS PRODUCTION	1,768	1,858	1,882	2,220
DEFENSE WASTE & TRANS. MGMT.	618	672	811	771
SECURITY AFFAIRS	186	194	210	255
DEFENSE PROGRAMS	$6,749	$6,905	$7,438	$7,852
			+7.7%	+5.6%

As for weapons activities, you can see that we went up a little bit in fiscal year 1987, and fiscal year 1988. In fiscal year 1989 it (indicating) is flat.

In fiscal years 1987 and 1988, Nuclear Materials Production is as flat as can be. It will go up a little in fiscal year 1989. But in Defense Waste and Transportation Management, we are going up a lot due to the approaching completion of the WIPP and DWPF facilities and the shift from construction to operations.

That is why there is a considerable jump here, and then we go down a little bit here (indicating).

In Security Affairs, it is still going up just a little bit. So, overall, it is about a 5 or 6 percent increase.

DEFENSE PROGRAMS FUNDING
FY 1988 CONSTANT DOLLARS
(DOLLARS IN MILLIONS)

	FY 1985	FY 1988	DIFFERENCE $	DIFFERENCE %
SAFEGUARDS AND SECURITY	$ 709	$ 702	- $7	- 1%
ENVIRONMENT, SAFETY, AND HEALTH	564	740	176	+31%
PROGRAM BASE	6,523	5,996	- 527	- 9%
TOTAL	$7,796	$7,438	-$358	- 5%

This gives you the trend.

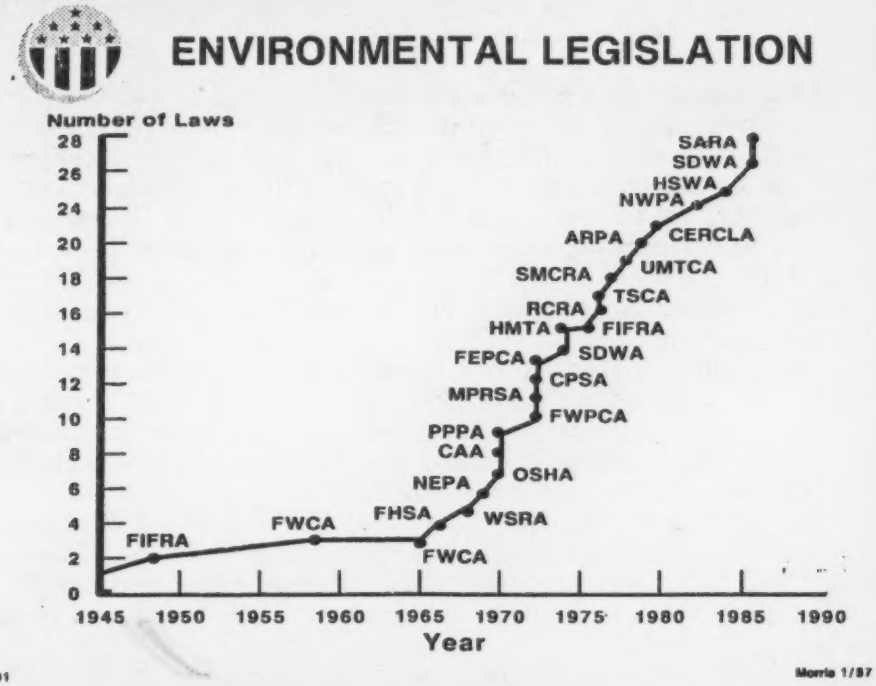
This is the concern and the trend. Our program base, down here (indicating), has gone down 9 percent between fiscal year 1985 and fiscal year 1988.

This is the production of materials and the production of weapons. It has gone down 9 percent.

Security and Safeguards from fiscal year 1985 to fiscal year 1988 is flat. It has only gone down 1 percent. But look at our environment, safety, and health program. It is up 31 percent.

That is just the beginning.

We are committed to it. We have to do it. There is no question about it. But it is going to cost you.



Let's talk about environmental legislation, just to give you a feel for the escalation in legislation over the past years.

This is a lovely slide. I love to throw this one on up.

Here is the problem. Here is what happened from 1965, in the last 20 years. It is entirely proper that we do this, of course. We need to do it. The Department is committed to doing it.

But you go to jail if you do not do these things. So, when we start talking about putting money into it, we had better put the money into it because here is the legislative track in the history that we have.

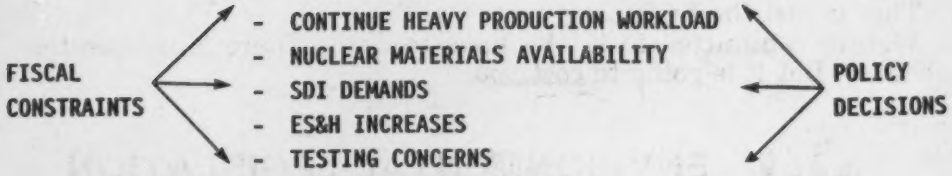
There are 28 laws, up through 1985, and there are more coming out along the line in here (indicating).

So, the States and the Federal Government are putting more restrictions on you all the time. But this is properly so. We are just smarter now. But it does cost you money, and you have to put it there, or we are all going to go the jail.

OVERALL PROFILE FOR FISCAL YEAR 1988

What is my conclusion?

CHALLENGE - MAINTAIN THE NUCLEAR DETERRENT



There is a one viewgraph conclusion.

The challenge is to maintain the nuclear deterrent. There are two major problems—fiscal constraints and policy decisions. We must meet the production load, maintain the nuclear materials availability, try to bring this fragile complex up to be more robust, and try to get a new production reactor. At the same time we have SDI demands.

These demands are going up. In addition, there are very real testing concerns.

I must tell you that as long as we have the strategic nuclear deterrent, as long as we have weapons, we must test. There are already significant restrictions on testing. The tests conducted are about half the number that are desirable, and they are limited to 150 kilotons. But we can live with that.

Our laboratory directors say that we can meet the requirements—we can design and build the weapons at 150 kilotons, but not if you limit us to some nebulous number underneath that.

We have moved down to an area where we cannot verify it, either.

So, those who sit out there with no responsibility for the program find it very easy to make cavalier or blithe statements that say we can do this or we can do that. I am telling you that we can't. We have to test and we need to stay at 150 kilotons.

Now, if somebody said reduce the number of tests by something, I might be able to live with that. But not the 150 kilotons. The 150 kilotons. to me is a very strict number that we need to see.

That, sirs, wraps up the defense programs from my viewpoint.

[The prepared statements of Admiral Foley and his Deputy Assistant Secretaries follow:]

PREPARED STATEMENT OF S.R. FOLEY, JR., U.S. DEPARTMENT OF ENERGY

Mr. Chairman and members of the committee, I am pleased to appear before you in support of the Department of Energy's (DOE) Atomic Energy Defense Activities authorization requests of $8.1 billion for fiscal year 1988 and $8.5 billion for fiscal year 1989. These requests include $612 million and $648 million respectively, for the Naval Reactor program which is run by Admiral McKee.

The 2-year authorization request is a step forward and complements our ongoing effort to further stabilize effective long-term program planning. I believe it will ultimately result in better management of our defense activities. This testimony focuses on fiscal year 1988 program requirements. These requirements were developed during a lengthy program and budget decision process which concluded only after extensive management participation throughout the entire Defense Programs complex. The fiscal year 1989 requirements are a logical follow-on to fiscal year 1988 in meeting our mission. It will be necessary to further refine our fiscal year 1989 request as fiscal year 1988 program and budget decisions evolve. I can assure you we will make every effort to work with you and your staff to fully comply with the intent and spirit of the fiscal year 1986 Defense Authorization Act.

DEFENSE PROGRAMS MISSION

For the Department of Energy and Secretary Herrington, I am responsible for three broad missions. First and foremost is our mission to support the national security policies of the United States for an effective nuclear deterrent. A variety of programs are incorporated in that envelope; developing and maintaining a superior research, development, and testing capability; producing and maintaining parts and nuclear materials for the weapons that make up our nuclear stockpile; processing waste generated from those efforts; and assisting other agencies in determining our adversaries' capabilities and compliance with treaties through verification and arms control activities.

Overlaying our primary mission are two other mission areas. First, we must assure that all of our facilities, materials, technology, and information are as safe and secured as possible. We routinely test our complex on an independent basis to verify its ability to withstand credible security threats.

Second, we have a major commitment to assure that all of our efforts function in a safe, healthful, and environmentally acceptable manner. Our expanding programs in this area will assure that Defense Programs activities function to acceptable standards in the future while redressing past deficiencies.

To support effective operation of the DOE nuclear weapons complex while meeting security and environmental responsibilities, I have enhanced the outyear program planning process by establishing Five-Year Program Analysis and Strategic Issues Analysis processes. These initiatives will help us to identify program activities of long-range strategic importance and balance, and rescope, or eliminate those programs of lower priority thereby assuring the efficient use of limited resources. During this first year of the process, senior managers at headquarters, field offices, and the weapons laboratories are collectively reviewing the status and scope of our activities to ensure that current and future program decisions are compatible with realistic workload projections and applications for our developing technologies. This is an evolving process and will lead to an integrated program plan for the future.

CHALLENGES AND PROBLEMS

The challenges and problems we face are significant. Many are calling for a nuclear testing moratorium, yet continued nuclear testing is absolutely essential to maintain our Nation's existing nuclear deterrent, verify future nuclear weapons applications, and evaluate the feasibility of the Nuclear Directed Energy Weapons (NDEW) concept. Since this time last year, the Chernobyl accident has focused even more attention on the safety of our aging nuclear production complex. Similarly, the fragility of the weapons complex tends to direct public attention to both our existing and potential environmental problems. The Department is resolved to accommodate our critical safety and environmental commitments, while balancing these requirements with competing program priorities.

Even in normal times, balancing competing program priorities is never an easy management assignment; but these are hardly normal times. Today we are faced with a combination of fiscal constraints; growing environment, safety, and health activities that I will address later; "must-do" restoration and maintenance efforts to support current and realistic future national security requirements; continuing production requirements reflected in the President's Nuclear Weapons Stockpile Memo-

randum; and funding our highest priority research and development activity—the development and testing of the NDEW concept in support of the Strategic Defense Initiative (SDI).

CHANGES IN OUR MANAGEMENT APPROACH

During my first year as Assistant Secretary for Defense Programs, I have become more conscious of the magnitude and scope of these and many other problems and challenges. In the short time I was on board before I testified last year, I was convinced we must change the way we do business. I am continuing to build on the strong consensus already within the Department that today's major program and budget decisions will have to fully involve field and laboratory management. Our Five-Year Program Analysis and Strategic Issues Analysis processes have achieved this coordinated approach for program planning purposes. As a result of these changes, the field role in the budget process has now been extended from the initial developer of the budget, to full partners in the final decisionmaking process.

We are also working closely with the Department of Defense (DOD) and are jointly developing realistic priorities and achieving a consensus on our short- and long-range plans and goals. A large part of our success is due to the effective implementation of the recommendations of the Blue Ribbon Task Group on Nuclear Weapons Program Management (BRTG). I note that we are seeing significant changes in processes and the philosophical approaches to the early phases of nuclear weapons development. We are participating earlier in the budget process through our input to the DOD Program Objective Memorandum, by providing weapons decision costs for better systems decisions, and working to better balance DOE facilities and capabilities with DOD requirements.

In a similiar fashion, the procedures and rules being jointly issued by DOE and DOD for the Nuclear Weapons Council are consistent with the spirit and intent of the BRTG recommendations. These procedures recognize that the nuclear weapons enterprise is a fully integrated process requiring budget integration and coordinated issue resolution.

These changes in our management processes have enabled us to prepare an authorization request that makes some tough choices among very competitive program activities. This has resulted in a balance of DOD needs with DOE capabilities in a restrained resource environment.

FUNDING REQUEST

Our program activities are carried out in a large and very complex network of production and laboratory facilities spread across the Nation. I have a very capable management and support staff in headquarters and in the field to direct the operation of this vast complex. Together, we are responsible for assuring that the nuclear weapons complex has sufficient operational capacity and capability to support national defense objectives.

The total budget request to support these activities will: Continue our active effort to restore, revitalize, and properly maintain aging DOE facilities; provide a balanced and vigorous research, development, and testing program; continue our commitment to meet critical environment, safety, and health, and essential safeguards and security needs; ensure progress in our effort to safely store and dispose of radioactive and hazardous wastes; meet the weapons production and nuclear material requirements in the President's Nuclear Weapons Stockpile Memorandum; and provide program growth for our highest priority research and development effort—Nuclear Directed Energy Weapons.

DEFENSE PROGRAMS
FY 1988/1989 CONGRESSIONAL REQUEST
(DOLLARS IN MILLIONS)

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WEAPONS ACTIVITIES	$4,177	$4,181	$4,535	$4,606
NUCLEAR MATERIALS PRODUCTION	1,768	1,858	1,882	2,220
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DEFENSE PROGRAMS	$6,749	$6,905	$7,438	$7,852
			+7.7%	+5.6%

We are requesting an authorization for Defense Programs of $7. 4 billion in fiscal year 1988 and $7. 8 billion in fiscal year 1989. This allows approximately 3% real growth over these two years. This growth goes principally to construction projects to maintain, restore, and revitalize the nuclear weapons complex, to our SDI efforts, waste management activities, and includes increases to meet our essential environmental and safety commitments.

Weapons Research, Development, and Testing

In the Weapons Research, Development, and Testing (RD&T) program, we will continue our efforts to maintain a strong technology research and development base. Virtually all of the growth in research and development in fiscal year 1988 supports determination of the technical feasibility of Nuclear Directed Energy Weapons concepts. Our commitment to support the national laboratories will continue with increases provided to sustain the weapons laboratory and testing facilities revitalization initiative. The nuclear weapons stockpile must continue to be reliable and effective. That can only be done by continuing essential underground nuclear tests. There are increases in the budget to provide testing to maintain a strong research and development technical base, modernize and validate the reliability of our weapons stockpile, and to support NDEW.

The fiscal year 1988 budget integrates the Weapons Core program, Nuclear Directed Energy Weapons, and Inertial Fusion research and development as subcategories under Weapons Research and Development to recognize the synergism of these activities. By establishing subcategories, this change is consistent with the need to report separately to Congress our SDI and Inertial Fusion programs. A similar change has been made to the weapons testing where the core program and NDEW are subcategories as well. However, in a practical sense, these activities are mutually supportive and should be managed as an integrated RD&T program.

Production

Essential new weapons deliveries can be made to meet the weapons production requirements directed by the President's annual Nuclear Weapons Stockpile Memorandum. In fiscal year 1988, six different weapons systems will be delivered and modifications made to one other. These requirements were the result of joint DOE/DOD assessments of DOE capabilities and DOD requirements.

We are strongly committed to continuing the long-term priority effort to maintain and modernize our production plants. This vast complex of aging production facilities and assembly plants is faced with severe production pressures trying to meet operational schedules. Increases in this budget support the goal of our restoration and maintenance program. We must ensure our facilities have the capability and capacity to meet production schedules, and in doing so, operate in a safe and effective manner.

Our fiscal year 1988 request also ensures continued availability of nuclear materials in the near-term. It will provide for adequate nuclear materials to produce weapons during the first five years of the Nuclear Weapons Stockpile Memorandum. However, we are concerned about our long-term ability to produce nuclear material. Accordingly, we are studying nuclear material supply options to meet our defense needs. A decision on our need for additional reactor capacity will be made in the near future. The request before you does not provide for new capacity at this time.

Defense Waste

We continue to support the aggressive effort to safely store and dispose of radioactive and hazardous wastes. Increases in FY 1988 will allow the continued transition from a storage mode of operations to preparation of waste for final disposal and ensure that the Defense Waste Processing Facility at the Savannah River Plant and Waste Isolation Pilot Plant near Carlsbad, New Mexico, become operational in the fiscal year 1988–1990 time period. This will allow completion of critical first elements of our Defense Waste Management Plan. We also are beginning to address the next phase of the plan by submitting a request for a high-level waste immobilization facility for the Hanford Reservation.

Eventually, defense high-level waste is to be disposed of in the geologic repository being developed under the Nuclear Waste Policy Act. We have not identified funds in the budget for the fee associated with this disposal. A Federal Register notice has been issued that addresses various methods of calulating the fee for defense waste. We will submit a budget request at the appropriate time pending a final decision on the method, timing, and amount of the fee.

Security Affairs

Finally, we have improved the Department's safeguards and security posture. The safeguards and security research and development program has played an important role in this accomplishment. Our request includes increases for this program to continue developing measures to ensure effective and efficient protection of the DOE's nuclear weapons, nuclear materials, facilities, and classified information against terrorism, theft, and compromise. Our budget request also provides for continued Verification and Control Technology activities with emphasis on the fabrication, demonstration, and deployment of both research and operational verification systems.

ENVIRONMENT, SAFETY, AND HEALTH

That describes the major thrust of our FY 1988 request. I would now like to share with you some of the challenges my managers have encountered in trying to meet environment, safety, and health (ES&H) requirements and still accomplish critical program activities. Their options for tradeoffs are becoming increasingly limited as our overall share of resources continues to drop while their ES&H obligations go up. Not too long ago we faced similar challenges in making our facilities and nuclear materials secure from potential adversaries. We met that challenge, and we are now turning the corner in the safeguards and security area. Our success in that arena, however, was largely accomplished when managers had a wide range of funding options available to them. Today, this flexibility is becoming more limited because of severe budget restraints. As expected, many of our managers have developed innovative ways to increase the leverage of their Federal dollars. Our long-range strategic planning and prioritization efforts will also help.

DEFENSE PROGRAMS ES&H FUNDING CROSSCUT
(DOLLARS IN MILLIONS)

	FY 1986	FY 1987	FY 1988	FY 1989
OPERATING EXPENSE	$449.0	$507.0	$547.0	$569.0
CAPITAL EQUIPMENT	34.0	39.0	37.0	52.0
CONSTRUCTION	89.2	119.5	155.9	186.0
TOTAL	$572.2	$665.5	$739.9	$807.0
ENVIR. COMPLIANCE & PROTECTION	316.2	371.5	432.9	471.0
HEALTH & SAFETY	256.0	294.0	307.0	336.0
TOTAL	$572.2	$665.5	$739.9	$807.0

Consistent with Secretary Herrington's plans to strengthen the Department's ES&H program, we are developing a comprehensive long-range plan for Defense Programs to better define the scope and cost of our existing and potential ES&H problems; but we already know it is going to be an expensive process. For example, we have preliminary estimates that our total ES&H funding level will exceed $800 millon in fiscal year 1989—this is up 41 percent from fiscal year 1986 and represents about 10 percent of our total fiscal year 1989 request. We are considering different approaches to provide the necessary resources for this activity, including establishing a separate budget category to comply with the Comprehensive Environmental, Regulatory, Compensation, and Liability Act.

I can assure you that we will continue to put forth our very best efforts to meet ES&H requirements and still accomplish priority mission objectives. With your help, we will comply with ES&H laws and regulations while meeting national security objectives.

CLOSING REMARKS

I personally want to thank you for your support over the past year. It has been a significant factor in the successful execution of our responsibilities. With your continued support and leadership, we will continue to provide this Nation with a strong nuclear deterrent capability. I urge the Committee's approval of our request, so we may again work together toward our common objectives. I look forward to working with you and your staff in the coming year, and I will keep the committee fully and currently informed of our progress. I will be pleased to answer any questions you may have.

PREPARED STATEMENT OF JAMES W. CULPEPPER, U.S. DEPARTMENT OF ENERGY

Mr. Chairman, members of the committee, it is a pleasure to appear before you to testify in support of the Department of Energy's Atomic Energy Defense Activities Authorization request for fiscal years 1988 and 1989.

1. INTRODUCTION

Mission of the Nuclear Weapons Program

The mission of the nuclear weapons program is to provide the Nation with a credible nuclear deterrent. This involves maintaining and modernizing the nuclear weapons stockpile and nurturing a strong nuclear weapons research, development, and testing program, which includes support for the President's Strategic Defense Initiative. Not only must we understand the feasibility and effectiveness of nuclear directed energy weapon concepts for our own applications, but for our own applications, but we must also understand how an adversary may use them against a United States retaliatory deterrent force or defensive system.

The theme that I would like to stress throughout my testimony is the national importance of the programs which must be managed in an efficient, effective manner while fully taking into account environment, safety, and health, as well as safeguards and security considerations. I would like to emphasize that the nuclear weapons activities are a major part of the Department's budget and as such receive commensurate attention and support throughout the Department. However, this critical national security program represents less than two percent of the Nation's overall defense budget.

I intend to discuss four subject areas: the resources we have to accomplish the program goals; some past and current year accomplishments; our fiscal year 1988-fiscal year 1989 budget requests; and, finally, some special items of concern to me as the acting director of the nuclear weapons program.

Resources

To accomplish the program mission, we need a balanced combination of highly experienced and qualified scientists, engineers and technicians, coupled with specialized equipment and facilities. People at the national laboratories are the primary resource. The Department of Energy laboratories have had good success in attracting and retaining highly qualified people to perform this invaluable work. A few years ago, a distinguished group of scientists selected the "100 Brightest Scientists in America Under 40" for *Science Digest*. Of the 100, 11 worked at the three weapons laboratories and another ten worked at other Department of Energy laboratories, giving the Department of Energy 21 percent of the total. Only two worked at other government laboratories.

This standard of excellence continues to be maintained at the laboratories. In 1986, *Research and Development* magazine identified the 100 most significant technological accomplishments throughout the world. The three DOE weapons laboratories had a total of 12 of the 100 awards. This is another indicator of the quality of the researchers, innovators, and developers at the weapons laboratories.

To maintain a credible deterrent, we must continually update the stockpile to meet needs imposed by a changing Soviet threat and target set. Improvements in our weapons spring from a technology base in such diverse fields as fission and fusion physics, shock hydrodynamics, chemistry and physics of high explosives, electronics, and many subfields of materials science and technology. These fields are explored in light of expressed needs for improved nuclear weapons and to avoid technological surprise, with investigation both in the experimental labortatory and underground testing site. Computation, diagnostic capabilities, and analysis go hand-in-hand with experimentation, and all are necessary for progress.

Expansion of computer capability is one measure of growth of our technology base. Since 1950, computation capabilities have increased by a factor of nearly 100,000. This increase actually represents developments in commercial computer technology and specialized codes developed for use in the weapons laboratories. Indeed, the needs of weapons technology have actually driven the development of supercomputers. Our advanced computers facilitate experiment modelling and analyses for the underground test program to ensure that our weapons are reliable and assist us in exploring advanced concepts to avoid technological surprise. I should emphasize that computers are not, and probably never will be, a substitute for underground testing.

Just as supercomputers are important to the weapons laboratories, computer integrated manufacturing is important to the weapons production complex.

Computer integrated manufacturing is systems integration encompassing all activities from the planning and design of products through manufacturing and shipping. In recent years, a transition has been made from the manual performance of operations to the use of computers to enhance design, planning, and manufacturing capabilities.

We are pleased with the implementation of the computer integrated manufacturing in the nuclear weapons production complex. We are proud to report that one of our contractors, Martin Marietta, the operator of the Y-12 Plant, has been recognized for its computer integrated manufacturing implementation efforts. Martin Marietta was the 1986 recipient of the "Leadership and Excellence in the Application and Development of CIM Award" of the Society of Manufacturing Engineers. This award is made in recognition of outstanding achievements in implementing computer integrated manufacturing technologies.

With respect to experimental facilities as a resource, many of the nuclear weapons program facilities have unique capabilities not found anywhere else in the country and, in some cases, in the world. For example, the High Explosives Applications Facility which is currently under construction, will be one of the most sophisticated high explosives research facilities in the world. High explosive performance is a vital part of the functioning of nuclear weapons. The Particle Beam Fusion Accelerator-II Facility—a multimegajoule, light-ion accelerator—is the only existing device that may have the potential of igniting thermonuclear fuel in the laboratory. Finally, NOVA, the world's largest and most powerful laser, provides unique capabilities for experiments in fusion, weapons physics, and areas of plasma and atomic physics. All of these facilities are essential to the maintenance of our technology base.

These resources were obtained as a result of your invaluable support over the years. Your continued support is needed to assure that the resources are sufficient to maintain a vital and robust nuclear deterrent. We have made a conscientious effort to balance the need between manpower, equipment, and existing facilities with the need for new capabilities. Our current planning for the future provides a "level-of-effort" funding for construction which addresses the highest priority facilities.

2. PAST ACCOMPLISHMENTS

Before I present the fiscal year 1988-1989 Weapons Activities program requests, I would like to highlight last year's weapons program accomplishments.

Weapons Production and Surveillance

In fiscal year 1986, the Department of Energy weapons production complex completed all of the required production milestones. [Deleted] new warheads were produced and delivered to the Department of Defense for deployment. We completed production of the W79 8-inch artillery-fired atomic projectile and the W85 Pershing II warhead; we continued production on the B61 tactical bomb system, the B83 strategic bomb, the W76 Trident I warhead, the W80-1 sea- and W-80-0 air-launched cruise missile warheads, and the W84 ground-launched cruise missile warheads; and accomplished initial production of the W87 Peacekeeper warhead system which led to an initial operational capability for this extremely important system in December of 1986. The introduction of the W87 Peacekeeper warhead system [chart 1 deleted] into the war reserve stockpile was, we believe, a particularly noteworthy achievement which exemplifies the finest cooperation among the Department of Energy laboratories, production facilities, and the Department of Defense in executing a fast-track warhead development program designed to meet a critical national defense need. Two new warheads progressed on schedule in the production engineering phase of development, the W88 Trident II warheads and the W82 155mm artillery-fired atomic projectile for which production will be initiated in fiscal year 1989 [deleted] respectively. In fiscal year 1986, considerable effort was also devoted to the upgrade of the reliability and safety of the existing stockpile with the completion of the B28 retrofit program and the continuation of the B61-1 and W31 warhead upgrade programs. Study efforts were also initiated with the Department of Defense to improve the command and control features of the W33 8-inch artillery-fired atomic projectile and to upgrade or replace the W50 Pershing 1a warhead. We, in the Department of Energy, continue to believe that an investment in continued stockpile reliability and safety is absolutely essential to our mission.

In fiscal year 1987, we expect to complete [deleted] transition two additional warheads into the design engineering phase of development—the Small Intercontinental Ballistic Missile warhead and the Short Range Attack Missile II warhead. The other warhead systems, mentioned earlier, will continue in production.

A cost-saving effort underway within the weapons production complex is the Plutonium Utilization Improvement Program instituted at the Rocky Flats Plant. Plutonium machining and foundry operations result in the production of plutonium oxide which must be reprocessed in order to recover valuable plutonium. The Plutonium Utilization Improvement Program implements procedures which are expected

to reduce by approximately 50 percent the amount of plutonium oxide generation. This program has required minimal capital investment to upgrade equipment in the plutonium foundry; however, it has resulted in the following benefits: Over $20 million in cost savings in recovery operations, and increases in the amount of plutonium available for production.

Weapons Research, Development, and Testing

Core Program

The weapons research, development, and testing core program encompasses the traditional nuclear weapons research, development, and testing necessary for the nuclear deterrent. Both inertial fusion and nuclear directed energy weapons research are part of the overall nuclear weapons technology base and should be treated as such in allocating weapons research, [deleted]. In this testimony, each is discussed separately because of specific interests and visibilities.

The first nuclear explosives and all weapons in the present stockpile produce isotopic radiation, blast and heat. Other weapons have been designed to produce tailored effects, e.g., x-rays, neutrons, and electromagnetic pulse. A logical extension of these developments is directed energy and is the primary area of the Department of Energy research in support of the President's Strategic Defense Initiative program.

The core program provides the capabilities necessary to: insure the integrity of the national nuclear weapons stockpile; develop producible weapons for that stockpile; sustain an innovative and future looking technology base for evolving future nuclear weapon capabilities; and to provide the scientific basis for avoiding technological surprise.

In the arena of nuclear weapons research, progress is exemplified by advances in understanding of nuclear explosive processes and effects; computation of criticality safety; electronic developments leading to improved arming, fusing, and firing systems; and [deleted].

We have made substantial improvements in electronic components and systems. [Deleted.] In the field of nuclear weapons development and engineering, we:

Completed the Short Range Attack Missile II and Small Intercontinental Ballistic Missile Phase 2 feasibility studies and selected the laboratory team to design the weapons for these systems.

Improved the safety, security, and reliability of nuclear weapons in the national stockpile by implementing new fire safety and use control features.

[Deleted.]

Surprises are encountered in some nuclear tests, some are small while others are more dramatic. This is to be expected because nuclear design is empirical, not a textbook science. Most nuclear tests involve unique features which contribute significant data to our base of weapon design knowledge. [Deleted.] It does clearly illustrate the continuing need to validate computer predictions by nuclear tests at our Nevada Test Site underground laboratory.

Nuclear Directed Energy Weapons

Support for the President's Strategic Defense Initiative program continues to be a major thrust of our research, development, and testing. The reasons for this research were articulated in a joint departmental policy statement signed in 1985:

(1) To determine the feasibility and effectiveness of counterdefensive nuclear-driven systems that an adversary may develop for use against future United States surveillance and defensive systems.

(2) To understand the technical feasibility and impact that such concepts might have on our deterrent forces if utilized in Soviet defensive systems.

(3) To explore nuclear directed energy options as Strategic Defense Initiative possibilities if needed.

Nuclear Directed Energy Weapons represent a new generation of tailored effects from a nuclear explosion. Nuclear Directed Energy Weapons research is the nuclear portion of the Strategic Defense Initiative program carried out by the Department of Energy. The basic concept is to convert a significant fraction of the immense energy from a nuclear explosion either into energy that is concentrated into intense, precisely directed, narrow beams or into a cluster of very small "pellets." Nuclear directed energy weapons have the potential of increasing the energy incident or distant targets [deleted].

Since we last appeared before this committee, there has been significant progress made by our laboratories in strategic defense research. [Deleted.]

A major study on utilizing laboratory facilities and capabilities was completed to complement the underground test program for the x-ray laser. The study was done to assure maximum benefits (increased data and understanding) to the program for resources expended.

A systems analysis methodology was developed to evaluate Nuclear Directed Energy Weapons concept missions in Strategic Defense Inititative architectures for both adversary threat and United States option applications. Mission analyses were completed for the x-ray laser and similar analyses for other Nuclear Directed Energy Weapons concepts were initiated. [Deleted.]

The Nuclear Directed Energy Weapons program continues to use the creative, efficient, and cost effective strategy of add-on experiments on other non-nuclear directed energy weapons underground nuclear tests [Deleted.]

Inertial Fusion

The inertial fusion concept is based on compressing fuel to extremely high density and heating it to the required temperature, so that the fusion fuel ignites and burns before the compressed mass has time to disassemble. An efficient pulsed-power accelerator using light-ion beams to compress fuel has been developed. Construction of the 100-trillion watt Particle Beam Fusion Accelerator [chart 2 deleted] was completed in December 1985 within budget and ahead of schedule. Because of the high efficiency and low cost of pulsed-power technology, the Particle Beam Fusion Accelerator II has enough to have the potential of igniting thermonuclear fuel targets. In the first year of operation, we have made substantial progress in characterizing the machine performance. This progress attests to the sound engineering design, our ability to understand and operate the accelerator, and to the future of the Particle Beam Fusion Accelerator II as an important laboratory capability.

Also during fiscal year 1986, NOVA [chart 3 deleted], in its first hohlraum experimental series, reached a new high of the density-time-temperature product needed for fusion ignition. [Deleted.]

Environment, Safety and Health

The Department of Energy has a continuing responsibility for providing a safe workplace for its employees, assuring protection for the health and safety of the public and protecting the environment. In past years this has meant doing as well as the best of private industry. Over the past several years many Federal, state, and local laws have been enacted to protect and rehabilitate the environment. These actions have placed additional requirements on the management and operation of our facilities.

The weapons production complex and the laboratories continued making progress in these areas during the past year. For example, the solar evaporation ponds at the Y-12 Plant, shown full and empty [charts 4 and 5 deleted], were used for percolation and evaporation of high-nitrate contaminated waste and had caused severe chemical contamination to the watershed in the vicinity of the Plant. Their use has now been discontinued. For handling of the closure of these ponds, the Y-12 Plant received an award from the Tennessee Society of Professional Engineers for the "Engineering Accomplishment of the Year." Their function, which was critical to continued operation of the production facilities, is now being handled by the West Tank Farm, the new $5 million Central Pollution Control Facility, and processing facilities at Oak Ridge.

A total of 10,330,000 gallons of wastewater was treated and released to East Fork Poplar Creek in accordance with a permit issued under the Clean Water Act. On May 30, 1986, the ponds were considered to be empty, completing the project at least two years earlier than had been projected if other special treatment facilities were used. This new process effectively demonstrated that wastewater containing nitrates and heavy metals in open ponds can be economically treated to meet the water quality criteria.

In response to the Comprehensive Environmental Response, Compensation, and Liability Act the Department initiated assessments to determine the status of its sites and to plan for remedial action. The first phase reports were completed for most sites and released to the appropriate regulatory authorities. As a result of these studies cleanup of 4.5 acres at the Pinellas Plant is underway; the north lagoon and underground tank farm at the Kansas City Plant have been removed from service and are being cleaned up; the Mound Plant has installed an advanced wastewater treatment plant to attain compliance with its National Pollutant Discharge Elimination System permit; and the boundary of the organic solvent contamination plume in the groundwater offsite from the Livermore National Labora-

tory has been determined. These studies should give us a good start towards meeting the requirements of the Superfund Amendments and Reauthorization Act which was passed by the last Congress.

With respect to nuclear material scattering safety, a fiscal year 1986 Congressionally approved project provides for a structural upgrade of existing plutonium facilities at the Rocky Flats Plant. This project is being accomplished and further reduces the already small offsite radiological risk from the Plant that might arise from an event such as an earthquake or tornado.

Safeguards and Security

The increase in malevolent incidents worldwide in recent years has motivated initiatives to improve the overall protective posture of the nuclear weapons complex. During the past year we have continued to make progress in improving the protection of our most critical assets. Our major thrust, to date, has been to upgrade our facilities against the potential outsider threat by employing a variety of new and advanced techniques and physical protection systems to detect and prevent potential malevolent acts.

A major improvement has been the increase in protective force numbers. The protective force regularly undergoes testing to maintain constant readiness. The September 1985, Department of Energy assessment states that "any adversary who attempts to gain control over or steal a nuclear weapon, a critical weapon component, or special nuclear material would face a high probability of failure." Notwithstanding this conclusion, the Department of Energy recognized the need for a number of actions to further improve the effectiveness and efficiency of the protection program. With actions identified to mitigate the outsider threat to an acceptable level, our emphasis now includes other areas including the development of additional protection systems and strategies to increase the level of confidence against the potential threats posed by an insider.

One result of these programs is that the weapons complex facilities have gone through a comprehensive program of physical security upgrades. Examples of some of the physical security upgrades are depicted on this chart [chart 6 deleted].

3. FISCAL YEAR 1988–FISCAL YEAR 1989 PROGRAM REQUEST

The Department of Defense Authorization Act, 1986, Public Law 99–145, requires a 2-year budget for the Department of Defense and related agencies. The fiscal year 1988/1989 budget request (chart 7), which totals $4.5 billion in fiscal year 1988 and $4.6 billion in fiscal 1989 supports the Nuclear Weapons Stockpile Memorandum and the critical activities of the research and development effort to maintain a credible nuclear deterrent and meet the milestones for a focused Strategic Defense Initiative. This request also reflects the Secretary of Energy's priorities for assuring facilities and materials are secure and safe from potential adversary actions and that environment, safety, and health concerns are identified and corrected in a responsible and cost efficient manner.

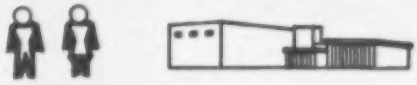
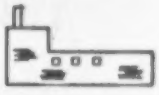
WEAPONS ACTIVITIES
(DOLLARS IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
RESEARCH AND DEVELOPMENT (R&D)				
OPERATING	$ 961.7	$1,011.1	$1,101.7	$1,087.4
CAPITAL EQUIPMENT	101.2	101.3	123.0	127.9
CONSTRUCTION	135.6	118.2	172.8	195.8
TOTAL R&D	1,198.5	1,230.6	1,397.5	1,411.1
TESTING				
OPERATING	522.4	532.9	583.9	560.0
CAPITAL EQUIPMENT	45.0	59.5	64.6	67.1
CONSTRUCTION	21.4	27.3	41.5	29.7
TOTAL TESTING	588.8	619.7	690.0	656.8
PRODUCTION AND SURVEILLANCE (P&S)				
OPERATING	1,741.3	1,813.3	1,911.3	2,035.9
CAPITAL EQUIPMENT	125.3	127.0	129.6	134.6
CONSTRUCTION	420.8	320.8	331.5	290.0
TOTAL P&S	2,287.4	2,261.1	2,372.4	2,460.5
PROGRAM DIRECTION				
OPERATING	102.7	69.8	74.8	77.8
TOTAL WEAPONS ACTIVITIES	$4,177.4	$4,181.2	$4,534.7	$4,606.2

The fiscal year 1988/1989 budget request provides for a balance between capacities to produce or improve weapons and the capabilities to design and test them; between people to perform research and facilities to conduct research in and between restoring the curruent asset base and adding new capabilities. Achieving this balance within available resources is a challenge to our management of the program that we recognize and accept. This chart (chart 8) depicts our attempts at balancing these elements.

CHART 8

BALANCED PROGRAM

- PEOPLE AND FACILITIES 
- DESIGN CAPABILITIES
- PRODUCTION CAPACITIES 
- RESTORE/MAINTAIN ASSET BASE
- ADD NEW CAPABILITIES
- PROTECT COMPLEX AND ENVIRONMENT

Weapons Production and Surveillance

The Weapons Production and Surveillance program supports the fabrication and assembly of nuclear weapons and weapons components, and stockpile maintenance and reliability assessment. The Production and Surveillance activities are supported by a nationwide complex of Government-owned, contractor-operated facilities managed by our Albuquerque Operations Office. Our fiscal year 1988/1989 budget request supports the production, stockpile improvement and preproduction activities for a wide range of warhead programs essential to the national defense interest (chart 9). We have requested $1.9 billion operating expenses in fiscal year 1988, an increase of $98 million representing a real increase of 1.5 percent over fiscal year 1987. The fiscal year 1989 request for operating expenses is $2.0 billion.

CHART 9

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

WEAPONS SYSTEMS IN PRODUCTION

- B61-3 BOMB
- B61-4 BOMB
- W80-0 SEA LAUNCHED CRUISE MISSILE WARHEAD
- W80-1 AIR LAUNCHED CRUISE MISSILE WARHEAD
- B83 MODERN STRATEGIC BOMB
- W84 GROUND LAUNCHED CRUISE MISSILE WARHEAD
- W87 PEACEKEEPER MISSILE WARHEAD
- W88 TRIDENT II WARHEAD

STOCKPILE IMPROVEMENT PROGRAM

- B61-1 BOMB CONVERSION TO B61-7 BOMB

PREPRODUCTION

- SHORT RANGE ATTACK MISSILE II
- SMALL INTERCONTINENTAL BALLISTIC MISSILE
- 155MM ARTILLERY-FIRED ATOMIC PROJECTILE
- NUCLEAR DEPTH/STRIKE BOMB

Although the total new production in fiscal years 1988 and 1989 is lower in terms of units produced than it has been in recent years, the equivalent workload, in terms of required outlays, continues to increase. Further production levels are projected to increase substantially in the later part of the approval period. The warhead-unit production ebb in fiscal year 1988/1989 is due mainly to the reductions that we absorbed in our fiscal year 1986 budget to comply with the Balanced Budget and Emergency Deficit Control Act of 1985 and, to some degree, due to revised military requirements. In fact, the fiscal year 1988 and fiscal year 1989 production levels, when normalized to the level of effort required due to varying production complexity factors and funding lead-times, are greater than the fiscal year 1987 level [chart 10 deleted]. Our fiscal year 1988/1989 budget supports the continuing build of B61-3/4 tactical bombs, the B83 Modern Strategic Bomb, the W80 warhead for the sea-launched and air-launched cruise missiles, the Peacekeeper Intercontinental Ballistic Missile, and the completion of the Ground-Launched Cruise Missile warhead program. In fiscal year 1989, we will also begin quantity production of the W88 warhead for the Trident II system and continue to retrofit the B61 strategic bombs.

Equally important is the fact that in fiscal years 1988 and 1989 we will be pursuing preproduction activities that will pave the way for the introduction of five extremely important warhead or bomb systems in the [deleted]. These systems include the Short Range Attack Missile II; the Small Intercontinental Ballistic Missile, which is an important part of the strategic missile modernization program; the 155mm Artillery-fired Atomic Projectile; a nuclear depth/strike bomb and, as mentioned earlier, the Trident II system warhead. These systems not only provide improved operational effectiveness but also continue our efforts to provide a safer and more secure nuclear weapons stockpile. We believe it essential that the Department of Energy's production complex be in a strong position to meet the workload requirements in the 1990s. This cannot be done unless we make the appropriate investments in fiscal year 1988/1989 to procure materials and tooling and accomplish the necessary facility construction and upgrade that are essential to the foreseen demands.

Through the formulation of the Nuclear Weapons Stockpile Memorandum, which the President approved on January 9, 1987, the Departments of Defense and Energy

worked closely together to develop a nuclear weapons development and production strategy which will not only meet our envisioned national security needs but is also very realistic in terms of warhead-to-platform delivery schedules and in the projection of future warhead requirements. Our fiscal year 1988/1989 budget request supports the Defense requirements and the resources to assure that the Nation maintains the necessary production capability base to meet future weapons production requirements.

Plutonium Recovery and Recycle

An activity of significant importance to the weapons program is the recovery and recycle of plutonium needed for nuclear weapons production. Recovery of plutonium from retired weapons and from manufacturing scrap is an important supply source as the operating reactors cannot provide all of the plutonium needed. Also, it is very economical when compared to meeting requirements through the production of new plutonium in reactors. The Rocky Flats Plant accomplishes most of the plutonium recovery. The New Plutonium Recovery Facility, known as Building 371, completed in 1981 was to have provided the Department of Energy with a replacement facility for the old Rocky Flats plutonium recovery facilities. Unfortunately, there were throughput problems with some of the Building 371 processes, and these processes are not economical to operate.

As General Withers indicated in his statement last year, the Department of Energy has been carefully studying the need, scope, and capacity requirements for options for a possible modification of Building 371 at the Rocky Flats Plant to correct deficiencies in its plutonium processing capabilities and to assure that sufficient plutonium is available for weapons production. We believe that existing older facilities will be able to supply plutonium in the interim period until replacement facilities are available. However, the processing capacity of these facilities is declining, and there is some concern for their continued availability in the near term.

In preparation for a possible Building 371 modification project, research, development, demonstration, and design activities are being undertaken. The purpose of these efforts is to clearly verify and demonstrate that the processing systems to be installed in the modification project will operate satisfactorily. One of these activities is the Plutonium Recovery Option Verification Exercise which has been underway for several years. The Plutonium Recovery Option Verification Exercise involves an effort to supplement the plutonium recovery technology base, and to verify the design, operability, reliability, and maintainability of the Building 371 modification. In addition, the Plutonium Recovery Option Verification Exercise will verify the decontamination procedures necessary for Building 371 modification; the equipment procurement, installation, and checkout procedures; and the management approach for accomplishing the modification project. The Plutonium Recovery Option Verification is being accomplished using operating funds in the amount of about $29 million over a five-year period. The Plutonium Recovery Option Verification demonstration modules will provide a limited supply of plutonium metal. This output will provide some contribution to the supply of plutonium in a period in which all sources are important.

Weapons Research, Development, and Testing.

The fiscal year 1988 request of $1.7 billion for weapons research, development, and testing operating expenses as shown in this chart (chart 11) will enable the Department to pursue the traditional core program which I will explain in detail as well as nuclear directed energy weapons research and inertial fusion research activities.

CHART 11

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

RESEARCH, DEVELOPMENT, AND TESTING - OPERATING EXPENSES
(DOLLARS IN MILLIONS)

	FY 1986 ACTUALS	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
CORE PROGRAM	$1,102.4	$1,131.2	$1,156.5	$1,201.9
NUCLEAR-DIRECTED ENERGY WEAPONS	243.8	270.0	416.6	328.7
INERTIAL FUSION	137.9	142.7	112.5	116.8
SUBTOTAL RD&T	$1,484.1	$1,543.9	$1,685.6	$1,647.4

Core Program

The core program (chart 12) which currently represents over two-thirds of the technical research and development manpower, is composed of two major elements: the technology base and the weapons development, engineering, and certification efforts.

CHART 12

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

RESEARCH, DEVELOPMENT, AND TESTING - CORE PROGRAM
(DOLLARS IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$1,102.4	$1,131.2	$1,156.5	$1,201.9
CAPITAL EQUIPMENT	115.4	119.8	139.6	144.9
CONSTRUCTION	155.0	130.7	192.3	207.9
TOTAL, CORE PROGRAM	$1,372.8	$1,381.7	$1,488.4	$1,554.7

The success of the Department of Energy in carrying out its mission to provide a credible nuclear deterrent relies directly on the depth and breath of its technology base. There is no industrial or academic counterpart to these capabilities elsewhere in the United States and, if lost or degraded, they cannot be replaced or restored easily or quickly. This capability has been an essential element of our nuclear deterrent for the past 40 years.

There are a number of major focal areas which drive the technology base research:

Weapon Safety: Minimize further the possibility of accidental detonation of high explosives, accidental nuclear yield, or accidental scatter of radioactive materials.

Weapon Use Control: The capability to prevent unauthorized use of nuclear weapons.

Efficient Packaging: Package devices of given yields into smaller sizes and/or less weight.

Tailored Efforts: Tailor weapon outputs for enhanced military effectiveness and/or reduced undesired effects.

Weapon Understanding: Understand better the physical processes which occur inside and outside a nuclear device when it explodes.

Related Basic and Applied Research: Exploratory work in basic and applied physics, chemistry, materials, and engineering to support the long range development of weapon technology.

The weapons development, engineering, and certification provides stockpile maintenance on a continuing basis and, in the near term, stockpile modernization. For stockpile maintenance we continue to monitor the safety, security, and reliability of those nuclear weapons in the stockpile. For example, in connection with the Stockpile Evaluation Program, each year samples of each type of weapon are taken from the stockpile for extensive inspections and component testing. Through these activities, problems have been discovered which have led to design changes and retrofits.

Many existing systems have remained in the stockpile longer than originally anticipated, exceeding their original design lifetimes. These weapons are reviewed annually with the Department of Defense, studying whether changes in weapons design and operational procedures are warranted to improve nuclear safety, security, or use control. For example, both the Nike Hercules warheads (W31) and B28 bombs are being improved [deleted]. Also, some of the B61 bombs are being upgraded with [deleted] insensitive high explosives. In addition, we are working on a new design for the Short Range Attack Missile that will improve performance and safety (use of insensitive high explosives). We will continue to evaluate other systems to ensure their safety, security, and reliability.

Stockpile modernization also includes developing new weapons in response to new threats to our security. [Deleted]. Another requirement is the warhead for the Small Intercontinental Ballistic Missile which complements the Peacekeeper program. The Small Intercontinental Ballistic Missile warhead will be a modified version of the Peacekeeper warhead, [deleted]. The mobile Small Intercontinental Ballistic Missile system is in response to the increased threat of Soviet weapon systems to our fixed-site deterrents such as the Minuteman weapon system.

Nuclear Directed Energy Weapons

The fiscal year 1988 request provides for a significant increase in our research, development, and testing activities dedicated to support the President's Strategic Defense Initiative (chart 13). Accelerated strategic defense research is necessary to meet our immediate objective of understanding the potential Soviet capability to design and deploy nuclear directed energy weapons that would put the United States retaliatory force or a future defensive system at risk, i.e., through technological "surprise." This information is needed as soon as possible because of the potential impact it could have on current nonnuclear strategic defensive initiative research and planning.

CHART 13

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

NUCLEAR DIRECTED ENERGY WEAPONS
(DOLLARS IN MILLIONS)

	FY 1986 ACTUALS	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSE	$ 243.8	$ 270.0	$ 416.6	$ 328.7
CAPITAL EQUIPMENT	21.3	32.2	42.0	44.0
STRATEGIC DEFENSES FACILITY	2.0	14.8	22.0	17.6
TOTAL, NDEW	$ 267.1	$ 317.0	$ 480.6	$ 390.3

Nuclear directed energy weapons are also being researched as United States strategic defense options. For the United States, nuclear directed energy weapons research is an especially attractive option for it permits us to exploit the advantages of high technology, an area of United States superiority. This provides us with the potential for offsetting the military advantages gained in recent years by the Soviet Union.

We believe the Soviets have been conducting strategic defense research for some time. Soviet work may have gone beyond laboratory research and experimentation in some cases. The Soviet Union has the world's only operational antiballistic missile system and a limited operational anti-satellite system.

[Deleted.] The Nuclear Directed Energy Weapons research initiated by the Department of Energy laboratories is part of their assigned mission to understand potential applications for advanced nuclear weapons technologies. These Nuclear Directed Energy Weapons concepts were under study as a fundamental part of our research efforts well before the 1983 announcement of the Strategic Defense Initiative. From the beginning, however, it was recognized that directed-energy nuclear weapons, if feasible, would find their most important applications in strategic defense. This new technology may make it possible to attack reentry vehicles at much greater distances than previously considered possible. Moreover, and of still greater potential importance, the technology of directed-energy nuclear weapons could introduce entirely new defensive options.

The Department of Energy is conducting research on four Nuclear Directed Energy Weapons concepts: [Deleted]. Looking to the future, fiscal year 1988 will be a critical year for our strategic defense research efforts. [Deleted]. We will need to sustain these important activities in fiscal year 1989 and beyond if we are to meet the Strategic Defense Initiative milestones.

The objective of the Inertial Fusion Program since its inception in the 1960s has been to determine if it is possible to ignite small masses of thermonuclear fuel in the laboratory for potential military and commercial applications. The motivation was creation of a capability to study fusion physics in the laboratory setting through the use of powerful laser and particle beams. [Deleted].

The program objective leads to a laboratory fusion capability which would make significant contributions to the development of nuclear weapons, to the study of some aspects of nuclear vulnerability and effects, and to the fundamental under-

standing and demonstration of many other applications of inertial fusion technology. The National Academy of Sciences panel chaired by Dr. William Happer asked the representatives of the laboratory weapons program, [deleted] to address the questions of the level of fusion yield that would represent a significant step forward in laboratory capabilities. From this dialogue was developed the target of 1000 megajoules (1/4 ton explosive equivalent yield) as the level at which a broad range of scientifically important results could be obtained [deleted]. Definition of the technical requirements for such a capability is the specific program goal articulated in the current Inertial Fusion Program plan. However, it should be noted that we do not believe a laboratory fusion capability can provide the totality of experience required to support the weapons development and stockpile maintenance responsibilities of the Department of Energy.

The objective of the near term program is to develop the physics and technology base required to project high gain performance with confidence, as well as to define the technology requirements and costs basis for construction of an affordance high gain fusion capability.

The near term program makes an additional important contribution to the weapons program by providing training in the skills of weapon designers and engineers in such critical areas as the various processes of functioning nuclear weapons, material science, nuclear diagnostics, [deleted] and high energy density sources such as lasers and particle beam accelerators. The inertial fusion technical base has also proven valuable for concept definition and testing in several areas of directed energy weapons research.

The physics and technology data bases required for the near-term goal will be addressed through three complementary efforts which will be supported in the fiscal year 1988 budget request. The fiscal year 1988 funding request as depicted in this chart (chart 14) is reduced from fiscal year 1987 level due to higher program priorities.

CHART 14

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

RESEARCH, DEVELOPMENT, AND TESTING - INERTIAL FUSION
(DOLLARS IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 137.9	$ 142.7	$ 112.5	$ 116.8
CAPITAL EQUIPMENT	9.5	8.9	6.0	6.1
TOTAL, INERTIAL FUSION	$ 147.4	$ 151.6	$ 118.5	$ 122.9

(1) High gain target physics and demonstration of target fabrication technologies [deleted].

(2) Target-driver interaction and hydrodynamics research with existing laboratory drivers, including research on scaled versions of high gain targets. [Deleted.]

(3) Driver technology development aimed at demonstrating the cost and technology requirements for a multi-megajoule laboratory microfusion facility.

Nuclear Emergency Search Team

The Nuclear Emergency Search Team represents the Department of Energy response to the need for a national capability which can effectively counter an attempt by terrorists or extortionists to achieve their objectives by utilizing stolen nuclear weapons, improvised nuclear devices, or radioactive dispersal devices. The Nuclear Emergency Search Team mission includes providing scientific and technical capabilities as depicted in this chart (chart 15), support for nuclear threat credibility assessment, search and detection of radioactive sources, gaining physical access to a suspect device, device diagnostics and disablement, collateral damage limitation, and nuclear effects prediction. This capability has been under development and refinement for almost a decade. The Nuclear Emergency Search Team concept has

been tested extensively during exercise situations and the search capability has been utilized in several actual incidents.

The mission and operational responsibilities of the Nuclear Emergency Search Team are based on the provision of the Atomic Energy Act of 1954, as amended; the Energy Reorganization Act of 1974, as amended; the Department of Energy Organization Act of 1977, Executive Orders (including Executive Order 11490, Executive Order 11953, and Executive Order 12333) and National Security Decision Directives, [deleted]. The overall Federal responsive capability to nuclear terrorism events is a national resource and the product of cooperation between several United States Government agencies. In addition to various resources of the Department of Energy, predominently Nuclear Emergency Search Team, the Department of Defense, the Federal Bureau of Investigation, and the Nuclear Regulatory Commission contribute significant expertise and manpower to maintain the overall capability.

Should a nuclear threat occur or is suspected to be developing, a cognizant government organization (such as the Federal Bureau of Investigation) would request that a threat credibility assessment be made by the Department of Energy. If the assessment evaluated the threat as credible, the Federal Bureau of Investigation would request appropriate Nuclear Emergency Search Team assistance from the Department of Energy. Appropriate Nuclear Emergency Search Team resources would be deployed under the direction of the Nevada Operations Office.

We have continued to develop and refine the Department of Energy capabilities and personnel through the use of drills and multi-agency exercises. During the last year three major Nuclear Emergency Search Team exercises were conducted to assure ourselves that we are prepared to meet various crises situations.

Program Direction

This activity (chart 16) provides for the Federal program direction oversight of the weapons program and community assistance at Los Alamos, New Mexico. Overall employment will increase by 9 full time-equivalents to 857 in fiscal year 1988. This provides the required Federal employees for the Albuquerque and Nevada Operations Offices as well as for Headquarters.

CHART 16

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

PROGRAM DIRECTION
(DOLLARS IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
PROGRAM DIRECTION	$ 102.7	$ 69.8	$ 74.8	$ 77.8

- o PROVIDES FOR 857 FEDERAL FTE's ($45.1M)
- o PROVIDES FOR NEEDED CONTRACTUAL SERVICES ($21.7M)
- o SUPPORTS THE LOS ALAMOS COMMUNITY ASSISTANCE PROGRAM ($8.0M)

Also provided under Program Direction are the needed contractual services. These services cover such items as security, janitorial, health, printing and reproduction, and technical assistance.

Plant and Capital Equipment

We are requesting $863 million for plant and capital equipment in fiscal year 1988, of which $546 million will be for construction of facilities. Five new projects are to support programmatic requirements. Two new construction projects are related to upgrading the physical security of our plants, and four new projects are related to environmental, safety, and health statutory or regulatory requirements.

Programmatic Construction Projects

The fiscal year 1988 budget request includes $262 million for construction projects directly related to supporting our programmatic mission of designing, developing, and producing nuclear weapons.

Prouduction and Surveillance

As presented in these charts (charts 17 and 17A), $41.9 million of this amount is included for initiating construction of three new projects in fiscal year 1988, (Small Intercontinental Ballistic Missile), High Explosive Machining and Facilities Capability Assurance Program.

CHART 17

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

PRODUCTION AND SURVEILLANCE - PROGRAMMATIC PROJECTS
(DOLLARS IN MILLIONS)

PROJECTS	TEC	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
88-D-122, FACILITIES CAPABILITY ASSURANCE PROGRAM, VL	$154.1	$ 0	$ 19.2	$127.3
88-D-125, HIGH EXPLOSIVE MACHINING FACILITY, PANTEX	60.0	0	2.7	13.0
88-D-127, SMALL INTERCONTINENTAL BALLISTIC MISSILE (SICBM) WARHEAD PRODUCTION FACILITIES, VL	65.0	0	20.0	17.0
87-D-122, SHORT RANGE ATTACK MISSILE (SRAM II) WARHEAD PRODUCTION FACILITIES, VL	69.5	1.0	37.0	19.2
87-D-123, PROTECTIVE CLOTHING DECONTAMINATION FACILITY, ROCKY FLATS	5.1	0.5	4.6	0
86-D-130, TRITIUM LOADING FACILITY REPLACEMENT, SAVANNAH RIVER	120.0	29.5	46.8	28.0
85-D-112, ENRICHED URANIUM RECOVERY IMPROVEMENTS, Y-12 PLANT	51.0	21.5	12.5	0
85-D-113, POWER PLANT AND STEAM DISTRIBUTION SYSTEM, PANTEX	26.3	5.5	2.0	0
85-D-115, RENOVATE Pu BUILDING UTILITY SYSTEMS, ROCKY FLATS	34.9	14.3	1.1	0
85-D-125, TACTICAL BOMB PRODUCTION FACILITIES, VL	27.1	13.1	0	0
84-D-112, TRIDENT II WARHEAD PRODUCTION FACILITIES, VL	156.1	12.1	3.3	0
82-D-109, 155MM ARTILLERY FIRED ATOMIC PROJECTILE	39.8	9.8	0	0
FY 1989 PROGRAMMATIC	TBD	0	0	20.0
TOTAL - PRODUCTION AND SURVEILLANCE PROJECTS		$ 97.5	$149.2	$224.5

Funding of $20.0 million is required in fiscal year 1988 to begin facility design, engineering and upgrades of the Small Intercontinental Ballistic Missile Warhead Production Facilities. The High Explosive Machining Facility at the Pantex Plant is needed to provide assurance for the continued and uninterrupted production of nuclear weapons. Machined high explosives parts are essential major components of all nuclear weapons produced at the Pantex Plant. The high explosive components are required to initiate a nuclear reaction in a weapon. The capability and capacity to machine these high explosive components are unique to Pantex; there are no commercial sources from which to obtain them. Pending the completion of the new High Explosive Machining Facility the existing facility will be operated utilizing revised personnel administrative controls relative to the exclusion area on the east and west ends of the current high explosive machining building.

The Facilities Capability Assurance Program is an FY 1988 initiative of the nuclear weapons production complex to manage actively capital resources to arrest and prevent the continuing deterioration of its aging facilities. The Facilities Capability Assurance Program is intended to be an ongoing program specifically designed to identify, manage, and correct long-term facilities deficiences within a specified annual funding ceiling. The Facilities Capability Assurance Program addresses long-

term solutions for utility capacity and capability problems and problems of poor and inadequate buildings and other real property improvements reaching the end of their useful life expectancies.

The production complex consists of more than 14.5 million square feet of buildings with over 70 miles of roads and 171 miles of fencing on more than 20,000 acres of land having a total estimated value of in excess of $8.3 billion excluding capital equipment. More than 55 percent of the facilities (structures, real property improvements, special facilities, and utilities) were constructed in the 1940s and 1950s. Many of these facilities have reached or exceeded their reasonable life expectancy, are in poor conditions, and/or are functionally inadequate to meet modern weapons production requirements.

An overall "investment strategy" is required to assure that the capabilites to meet the production complex's national security mission is not impaired as these facilities suffer the wear and tear of continued utilization. The deterioration problem was first identified in the Restoration Program which addressed production equipment and utilities.

The appraisals conducted as part of the Restoration Program identified many deficiencies that were beyond the limited scope of that program.

The Facilities Capability Assurance Program utilizes a documented, audible appraisal program to identify poor physical conditions, functional inadequacy, and capacity and capability problems of facilities and utilities to meet current production complex program requirements.

Research, Development, and Testing

The nuclear weapons research, development, and testing process requires highly specialized facilities to achieve programmatic goals. A decade of decline in the 1970s of advanced research, development, and testing effort and minimal construction funding for the weapons research, development, and testing complex created a backlog of critically needed facilities to replace aged facilities and to provide facilities which meet the technological need and standards for the mission needs of the 1980s and beyond. The research, development, and testing research complex covers almost 18 million square feet of facilities with an estimated replacement value of $7 billion. Many of these facilities were constructed in the 1950s creating a current need for replacement and refurbishment. As indicated in my next chart (charts 18 and 18A) $39.0 million is requested to initiate construction of two new projects in fiscal year 1988.

CHART 18

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

RESEARCH, DEVELOPMENT, AND TESTING - PROGRAMMATIC PROJECTS
(DOLLARS IN MILLIONS)

PROJECT	TEC	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
89-D-XXX, NEW PROJECTS	TBD	$ 0	$ 0	$ 36.2
88-D-105, SPECIAL NUCLEAR MATERIALS R&D LABORATORY REPLACEMENT, LANL	$ 210.0	0	10.0	22.0
88-D-106, REVITALIZATION, PHASE II, VARIOUS LOCATIONS	359.8	0	29.0	80.0
86-D-104, STRATEGIC DEFENSES FACILITY, SNLA ..	70.0	14.8	15.0	3.0
86-D-105, INSTRUMENTATION SYSTEMS LABORATORY, SNLA	19.9	7.3	8.0	1.5
86-D-106, LABORATORY DATA COMMUNICATIONS CENTER, LANL	25.0	11.8	12.2	0
85-D-102, REVITALIZATION, PHASE I, VARIOUS LOCATIONS	$ 152.3	$ 40.0	$ 33.5	$ 5.7
84-D-102, RADIATION-HARDENED INTEGRATED CIRCUIT LABORATORY, SNLA .	47.5	3.0	0	0
84-D-107, TESTING REVITALIZATION, VARIOUS LOCATIONS .	79.2	9.8	5.5	0
82-D-144, SIMULATION TECHNOLOGY LABORATORY, SNLA ..	39.9	5.9	0	0
TOTAL, RD&T PROJECTS		$ 92.6	$ 113.2	$ 148.4

The Special Nuclear Materials Research and Development Laboratory Replacement at the Los Alamos National Laboratory will replace and refurbish aging laboratories that are 33 years old. The project is critical to maintaining the Laboratory's plutonium processing facility operations and support to the nuclear weapons complex. This project will allow the Department of Energy to continue long-term, safe, and secure operations of essential chemistry and metallurgy research and development services in support of plutonium processing facility operations. The present Chemistry and Metallurgy Facility will be almost 40 years old when the replacement facility is completed. We will continue to operate the present facility in a safe and reliable manner; however, if replacement efforts are not started, a potential situation could arise forcing the closure of the present building and supporting systems. If the present facilities were shutdown, plutonium operations would essentially come to a halt at the Los Alamos National Laboratory effecting research, development, testing, and production programs.

There is a potentially serious situation in the current chemistry and metallurgy laboratory and support systems that could adversely affect the safety of personnel and that would require shutting down the laboratory. If the laboratory was shutdown, operations and research and development at the plutonium facility would essentially come to a halt and test program objectives and other commitments to the national defense programs would not be met.

The remaining programmatic construction projects directly relate to maintaining the basic research, development and testing capability. The new starts included within the Revitalization project, an initiative started in fiscal year 1984, provides for the construction of new facilities; modifications, relocations, and additions to ex-

isting facilities. They will provide new research capabilities at the Los Alamos National Laboratory, the Lawrence Livermore National Laboratory, and the Sandia National Laboratories to meet the research, development, and engineering needs of the future, and new essential support facilities for the weapons testing activities at the Nevada Test Site. The purpose of this ongoing programmatic effort of revitalization is to ensure a research, development, and testing complex with the technological capabilities and supporting facilities to meet the research, development, and testing mission requirements.

Environment, Safety, and Health

The Department maintains a continuing responsibility for the protection of the health and safety of its personnel, its contractors' employees and the general public. Emphasis is placed on radiological protection throughout the nuclear weapons program, with renewed emphasis placed on addressing potential nonradiological hazards to the environment and to public and employee health and safety which were not recognized even a decade ago. This renewed emphasis responds to the increasing requirement resulting from Federal, state, and local laws and regulations. Within the Department of Energy, from the Secretary down to program line managers, responsibility and accountability for implementing environmental, safety, and health activities are emphasized.

I am requesting funding for specific line item construction projects which are needed to meet state or Federal requirements. Failure to fund these projects may result in a failure to meet compliance orders and other state/Federal action and could result in litigation and the potential for shutdown of the particular facilities.

A summary of the $47.9 million of construction funding requested for environment, safety, and health activities is given in chart 19 and 19A. The five new starts in fiscal year 1988 are required to address compliance issues, including: initiation of cleanup of offsite groundwater contaminated with organic solvents which have migrated from spills and waste disposal leakage at the Lawrence Livermore National Laboratory; correction of the sanitary sewage collection and treatment system problems at Los Alamos National Laboratory to meet Clean Water Act requirements; provide seismic upgrade to Building 111 at Lawrence Livermore National Laboratory to meet the current life safety goal of the Uniform Building Code; provide fire protection upgrades for several critical facilities in the weapons complex; and, provide personnel radiation monitoring laboratories at several locations in the complex so that dosimetry programs will meet the performance criteria set out in the Department's Laboratory Accreditation Program. Continuation of six prior-year projects is required in responding to previously identified protection and compliance issues.

CHART 19

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

ENVIRONMENT, SAFETY, AND HEALTH (ES&H) PROJECTS
(DOLLARS IN MILLIONS)

PROJECTS	TEC	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
89-D-XXX, NEW CONSTRUCTION STARTS	TBD	$ 0	$ 0	$ 13.6
88-D-102, SANITARY WASTEWATER SYSTEMS, LANL	$ 16.7	0	1.0	7.6
88-D-103, SEISMIC UPGRADE, LLNL	6.8	0	1.1	5.7
88-D-124, FIRE PROTECTION UPGRADE, VL	15.3	0	1.7	6.5
88-D-126, PERSONNEL RADIOLOGICAL MONITORING LABORATORY, VL	6.1	0	1.0	5.1
87-D-102, ENVIRONMENTAL COMPLIANCE AND CLEANUP, LLNL ...	24.7	0	9.0	12.0
87-D-127, ENVIRONMENTAL, SAFETY, AND HEALTH UPGRADE, MOUND	4.1	2.4	1.7	0
86-D-103, DECONTAMINATION AND WASTE TREATMENT FACILITY, LLNL	40.9	5.3	12.0	8.5
86-D-122, STRUCTURAL UPGRADE OF Pu FACILITIES, ROCKY FLATS	$ 5.6	$ 2.6	$ 0.2	$ 0
86-D-123, ENVIRONMENTAL HAZARDS ELIMINATION, VL	38.5	18.0	13.3	0
85-D-121, AIR AND WATER POLLUTION CONTROL, Y-12 PLANT .	29.0	9.8	1.0	0
84-D-124, ENVIRONMENTAL IMPROVEMENTS, Y-12 PLANT	45.4	9.8	5.9	1.4
TOTAL, ES&H CONSTRUCTION		$ 47.9	$ 47.9	$ 60.4

Additional environment, safety, and health protection and compliance issues will be addressed through requested operating funds. This includes such items as salaries for staff dedicated to environment, safety and health activities, personnel protective equipment, general orientation training of all personnel and special training for special staff, environmental monitoring and surveillance costs, health clinics, and fire protection equipment and personnel.

Safeguards and Security Construction

We have been systematically enhancing the protection of the weapon complex in recognition of the need to continue to improve, refine, and upgrade our operations in this area to meet the defined threat to our vital assets. As a result, our facilities have gone through a comprehensive program of significant physical security upgrades in the recent past and we are continuing with that program.

The fiscal year 1988 request of $76.2 million (charts 20 and 20A) includes $9.2 million for the initiation of two new construction projects, one at the Los Alamos National Laboratory in New Mexico and the other at the Pantex Plant in Amarillo, Texas. The balance of the fiscal year 1988 authorization request continues seven prior-year construction projects at various weapons complex sites.

CHART 20

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

SAFEGUARDS AND SECURITY (S&S) PROJECTS
(DOLLARS IN MILLIONS)

PROJECTS	TEC	FY 1987 APPROPRIATION	FY 1988 REQUEST	FY 1989 REQUEST
88-D-104, SAFEGUARDS AND SECURITY UPGRADES, PHASE II, LANL	$ 15.3	$ 0	$ 3.5	$ 11.6
88-D-123, SECURITY ENHANCEMENTS, PANTEX	109.7	0	5.7	7.5
87-D-104, SAFEGUARDS AND SECURITY ENHANCEMENTS II, LLNL	28.9	2.0	7.0	10.1
87-D-130, RECEIVING AND SHIPPING FACILITY, PINELLAS	2.7	0.3	2.4	0
86-D-125, SAFEGUARDS AND SITE SECURITY UPGRADE, PHASE II, PANTEX	9.8	6.4	2.0	0
86-D-124, SAFEGUARDS AND SITE SECURITY UPGRADE, PHASE II, MOUND	4.8	3.0	0	0
85-D-103, SAFEGUARDS AND SECURITY ENHANCEMENTS, LLNL/SNLL	36.7	6.8	9.2	0
85-D-105, COMBINED DEVICE ASSEMBLY FACILITY, NTS	$ 69.5	$ 9.8	$ 28.0	$ 21.7
85-D-106, HARDENED ENGINEERING TEST BUILDING, LLNL	3.1	0.4	0.1	0
85-D-123, SAFEGUARDS AND SITE SECURITY UPGRADE, PHASE I, PANTEX	4.8	1.0	0	0
84-D-211, SAFEGUARDS AND SECURITY UPGRADE, Y-12 PLANT	68.0	29.5	18.3	0
84-D-212, SAFEGUARDS AND SITE SECURITY UPGRADE, PINELLAS	7.2	1.0	0	0
TOTAL, S&S CONSTRUCTION		$ 60.2	$ 76.2	$ 50.9

The $109.7M Safeguards and Security Upgrade Project at the Pantex Plant [deleted].

The $15.3M Safeguards and Security Upgrade, Phase II Project, at Los Alamos [deleted]. The protection program needs these upgrades to assist us in defeating the defined threat to the Los Alamos National Laboratory.

These projects address identified vulnerabilities that continue to exist at both these sites. We must continue to take timely actions to correct identified vulnerabilities and to pursue better ways to improve the effectiveness of our protection programs and plant operations.

4. CONCERNS

Underground Nuclear Testing

The United States relies on the credibility of its nuclear forces as the foundation of its policy of deterrence. The United States must maintain an effective, survivable, and varied nuclear force to convince any adversary that we could retaliate decisively in the event of aggression against us or our allies. A ban on nuclear testing would do serious damage to the credibility of the deterrent and thus, endanger world peace and stability. President Reagan summarized the United States position on banning nuclear tests in a letter to the Allies on March 14, 1986:

"A comprehensive test ban remains a long term objective of the United States. We believe such a ban must be viewed in the context of a time when we do not need to depend on nuclear deterrence to ensure international security and stability and

when we have achieved broad, deep, and verifiable arms reductions, substantially improved verification capabilities, expanded confidence-building measures, and greater balance of conventional forces."

A nuclear test ban would eliminate our ability to perform confidence tests of the current nuclear stockpile. This would prevent detection and/or correction of possible stockpile problems of the future. Had it not been for nuclear testing in the past, many problems would have gone undetected and our confidence in the capabilities of these weapons would have been an illusion. Nuclear tests are also necessary to verify that any fixes made to deteriorating or faulty weapons are effective (charts 21, 22, 23). (Charts 21 and 23 deleted.)

CHART 22

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

NUCLEAR TESTING IS NECESSARY FOR CREDIBLE DETERRENT

- ASSURE RELIABILITY OF THE CURRENT NUCLEAR STOCKPILE
- EXPLORE PROMISING NEW CONCEPTS
- DEVELOP, WEAPONIZE, AND CERTIFY NUCLEAR WEAPONS FOR NEW APPLICATIONS
- UNDERSTAND NUCLEAR EXPLOSIVE PROCESSES
- INVESTIGATE THE EFFECTS OF NUCLEAR EXPLOSIONS ON MILITARY SYSTEMS
- AVOID TECHNOLOGICAL SURPRISE

Under a test ban, new developments required to maintain the credibility of our deterrent into the future in the face of the changing Soviet threat could not be pursued. [Deleted.] Remember that delivery systems and their associated nuclear weapons are often made obsolete by nonnuclear developments that the Soviets will pursue regardless of nuclear testing, for example, improvements in air defenses, submarine detection, hardening, dispersal of forces, mobility, etc. Incorporation of many of the most modern nuclear weapon safety and security measures would not be possible under a nuclear test ban. The nuclear weapons in the stockpile are as safe as it was possible to make them when they were produced. However, if improvements can be made, we should not have to compromise because of an inability to certify performance. A critical aspect of future technology involves the development of nuclear directed energy weapons. Exploration of most Nuclear Directed Energy Weapons concepts involving nuclear explosives will not be possible under a test ban. Assessment of United States vulnerabilities to Soviet directed energy weapons of these types (which may already exist) will be precluded, as well. In fact, all testing to assess the vulnerability to nuclear weapon effects of United States military systems such as missiles, aircraft, radars, surveillance satellites, and so on, will be severely limited by a halt to nuclear testing.

Without the ability to do satisfactory experiments, the small number of top-level weapons scientists that we currently have would leave for other occupations, compounding the difficulties of analyzing and correcting future stockpile problems. Cost savings will be virtually non-existent. The nuclear design laboratories, the test site, and most of their facilities (and associated costs) will still have to be maintained.

Some have considered reducing the current 150 kiloton threshold, but this would be a mistake. Today, this threshold restricts us from conducting full-yield tests of many of our most important strategic nuclear weapons. Reducing the threshold further would, in addition, restrict us from testing critical components of most weapons to verify their performance, for example, [deleted].

Because of this country's reliance on a nuclear defense, it is often stated or assumed that it is the most expensive form of defense and that the quantity and total explosive yield of our nuclear weapons stockpile has increased steadily. In reality, the cost of maintaining a strong nuclear deterrent, along with the necessary, associated nuclear testing, is substantially cheaper than the cost of increasing our conventional forces to be on par with the Soviets and their allies. [Deleted] the United States stockpile, while incorporating numerous technological improvements is near its lowest numerical level in more than 20 years. Our total explosive megatonnage has likewise been reduced by [deleted] since 1960.

Continuing Need for Nuclear Weapon Research

We see a continuing need for an active nuclear weapons research, development, and testing program in order to maintain United States deterrence. To maintain the credibility of our deterrent, new nuclear weapons need to be developed to address these emerging threats. [Deleted.]

The Soviets are going to mobile missile launchers and mobile command posts, thereby reducing our ability to hold them at risk. Present systems cannot effectively attack these. In addition, further deployment of a Soviet ABM system will demand new weapons to effectively attack them. Similarly, other new threats which are not adequately addressed at present will continue to emerge.

Continuing the United States developments of the past two decades, we see a strong continuing trend to develop safer, more secure systems. This need is especially heightened with the increasing terrorist presence around the world. More secure designs are possible but may demand new nuclear system designs. Also as Soviet capabilities develop to counter our weapon systems, new advanced systems will be required to assure weapon system survivability. For example, weapons to be deployed on stealth vehicles may have special demands in size and shape.

Another important reason for continued research and development efforts is to avoid technological surprise. It is important to be aware of what is possible in nuclear weapon design to avoid being caught at a fatal disadvantage due to technological developments by an adversary. It is also vital to ensure that we do not get surprised by unexpected material behavior as our own weapons age in the stockpile.

Blue Ribbon Task Group

I would now like to discuss our actions taken during the past year in support of the recommendations provided by the Blue Ribbon Task Group on Nuclear Weapons Program Management. Rather than cover each recommendation in detail, I will defer that to the March 1 report required by the Congress in the fiscal year 1987 Defense Authorization Act and instead highlight some of the activities in support of three major themes of particular interest to this committee—inceased cost consciousness, improved cost management, and more effective interface with the Department of Defense.

I firmly believe that the intent of the Blue Ribbon Task Group in the area of increased cost consciousness is being met by the Department of Energy and the various joint Department of Defense/Department of Energy working groups. The past year saw significant changes in processes and the philosophical approach to the early phases of nuclear weapons development, directly leading to heightened cost consciousness and restoration of a more balanced relationship among cost and other factors in defining military requirements and the Department of Energy warhead design options.

The Department of Energy is aggressively questioning the validity and resource implication of military characteristics being requested by the Services. Cost information is being gathered on those requirements that drive design characteristics so that valid and timely tradeoffs of costs and benefits can be performed. Where costs are judged to outweigh benefits, military charcteristics are being reconsidered and changed as appropriate to allow for lower cost warhead designs.

There are several recent examples of the newly emerged importance of warhead costs. In the case of the Air Force's Short-Range Attack Missile II, early decision cost estimates were developed for 13 design candidates prior to warhead design and design team selection by the Department of Energy. This is the first time that significant cost datum was available for consideration before a weapon system entered

Phase 2a, the design definition and costing phase. This allowed the Department of Energy to make a better-informed selection decision, conserve scarce research and development funds, and get an early start on design engineering work. It should also be noted that the Air Force made substantial changes to its requirements on the weapon due to the Department of Energy cost factors. The final selection of the baseline design for the Navy's Nuclear Depth/Strike Bomb will not be made until cost data are gathered for a wide variety of requirement and design options. Already several important changes have been made to the requirements and the design characteristics to reduce costs.

I must emphasize again that we are not compromising fundamental and well-defined warhead requirements, but rather assigning cost an appropriate priority in the decision equation.

Tied in closely with increased cost consciousness at all levels of management are our activities to improve internal cost management systems and external cost reporting. Most of the work on improving internal cost management is being performed by the Department of Energy's Albuquerque Operations Office in conjunction with the production plants and weapon laboratories. The basic thrust is to develop a system for establishing a baseline management cost for each weapon system and to monitor that cost through production. We are currently defining baseline cost management, the Albuquerque Operations Office is working to improve indicomplex, and restructuring weapons program schedule and cost-tracking systems to provide timely cost reporting and status information. In addition to weapon system cost management, the Albuquevgue Operations Office is working to improve indirect cost management policies and procedures. Finally, cost management has been introduced as a factor in the award fee process for our contractors.

The major initiative in the area of external cost reporting has been the Nuclear Weapons Acquisition Report. The initial report was provided to the Congress last March and, I believe, was well received. It provides the reader with more meaningful explanations of program status, costs, and factors contributing to cost changes. Perhaps of more importance for cost management is its value as the common definitional basis upon which decision costs for tradeoff purposes will be expressed and the baseline cost for a weapon system will be structured. I believe that this responds to one of the fundamental concerns expressed by the Blue Ribbon Task Group.

In terms of our interface with the Department of Defense, I have already mentioned several positive changes in the day-to-day working relationship. At Headquarters, we are emphasizing a more proactive interface with the Department of Defense in three major arenas—the Defense Resources Board, Joint Requirements Management Board, and the newly established Nuclear Weapons Council. Last summer, as part of the fiscal year 1988 budget review process, we provided a Program Objective Memorandum-like document to the Defense Resources Board. This document identified decision costs by weapon system for the five-year defense program period and highlighted several issues of relevance to both Departments. We also reviewed and provided comments on issue papers affecting the Department of Energy nuclear weapons requirements. We are invited to attend Joint Requirements Management Board meetings as an observer when those meetings pertain to nuclear systems.

Finally, the Nuclear Weapons Council which held its first meeting earlier this month offers much promise as a high-level focal point for those major issues of joint concern to both Departments. The Secretary of Energy has designated the Assistant Secretary of Defense Programs to represent the Department on this council. Although the responsibilities and membership of the Nuclear Weapons Council were identified in the fiscal year 1987 Defense Authorization Act, we are actively working with the Department of Defense to define a supporting structure to maximize the effectiveness of the Nuclear Weapons Council itself.

Finally, I would like to assure this committee that all levels of the Department of Energy management are firmly committed to the purpose and intent of the Blue Ribbon Task Group recommendations. Our actions have been positive, and aggressive. Tangible benefits have already been realized. We will continue to pursue this matter diligently.

SUMMARY

In summary (chart 24), our request, if sustained, fully supports the Presidentially approved Nuclear Weapons Stockpile Memorandum as well as the President's Strategic Defense Initiative program. Inertial Fusion is integrated into the weapons research, development, and testing and continues support for the non-Department of Energy laboratories. Funding is provided for an austere continuation of the restora-

tion and revitalization efforts. Provision is also made for those activities and projects necessary to comply with statutory environmental, safety, and health requirements and to enhance security throughout the weapons complex.

CHART 24

DEFENSE PROGRAMS — WEAPONS ACTIVITIES

SUMMARY

- SUPPORTS REVITALIZATION/FACILITIES CAPABILITY ASSURANCE PROGRAM.
- SUPPORTS THE NUCLEAR WEAPONS STOCKPILE MEMORANDUM.
- SUBSTANTIAL INCREASE IN NUCLEAR DIRECTED ENERGY WEAPONS (NDEW).
- SUPPORTS NEEDED ES&H AND S&S PROJECTS.

We are making substantial progress on the nuclear weapons program objective of assuring peace through a nuclear deterrent. We thank you for your support in the past and seek your support of the funding request before you.

In closing, I would like to thank you for your strong support through the years and for the opportunity to appear before you today.

STATEMENT OF
JOHN L. MEINHARDT
DEPUTY ASSISTANT SECRETARY FOR NUCLEAR MATERIALS
U.S. DEPARTMENT OF ENERGY

Mr. Chairman and Members of the Committee; I am John Meinhardt, Deputy Assistant Secretary for Nuclear Materials, within the Defense Programs sector of the Department of Energy. It is my pleasure to appear before you to provide testimony regarding the Department's budget request for the Nuclear Materials program in FY 1988 and 1989.

Responsibilities of this position include the production of nuclear materials for the nuclear weapons complex and the management and disposal of nuclear wastes from all of the Department's defense activities. I thank the Committee for the support you have given to these activities, and particularly your support during the recent months as we reviewed the safety of N Reactor in Richland, Washington, in light of the Chernobyl accident, and as we developed our conclusion that C Reactor at the Savannah River Plant would remain shut down.

Nuclear materials production and defense waste management consist of a complex of nuclear production reactors, metal foundries, chemical processing plants and waste facilities that constitute a multi-billion dollar industry unto themselves. It is an industry with both unique hazards and important product requirements, requiring careful consideration of quality assurance and internal regulation. The original technology and facilities for producing nuclear materials were placed in operation quickly in the 1940's to meet immediate military requirements. Most of the current facilities were built in the 1950's and early 1960's to meet similar requirements. These dedicated facilities are the sole source of tritium and plutonium in the United States to meet national Defense nuclear materials requirements.

We, therefore, must always be mindful of maintaining the capability and reliability of these facilities while planning and developing new technologies and facilities to meet the future requirements.

With your support we have continually increased production in the 1980's. We felt that Nuclear Materials Production was back on the road toward reliable operation and sufficient capacities to meet defense requirements. However, we did not anticipate the impacts of the accident at Chernobyl, or the discovery of cracks in the C Reactor tank. The Chernobyl accident has resulted in placing N Reactor in a 6-month standdown in order to accomplish accelerated safety improvements. The cost associated with repairing the C Reactor tank, in conjunction with the age of the facility, has led to the decision to place C Reactor in cold standby. These and other recent events have highlighted just how fragile the nuclear materials production system is.

Fortunately, the requirement for new materials projected in the 1987-1992 Nuclear Weapons Stockpile Memorandum (NWSM) are somewhat reduced from last year's NWSM. However, due to the fragility of the production complex, it is very important to continue our programs of productivity retention and improved facility maintenance. This will enable the program to maintain production capacity and capability. DOE and Congress must continue to work together to find solutions to the problems associated with these aging facilities and the increasingly stringent environmental, safety, and health and safeguards and security requirements. Without these solutions or alternate sources for nuclear materials, the Nation's nuclear defense posture will be in jeopardy.

Within the Defense Waste and Transportation Management (DWTM) program, the Department has made a commitment not to build new high-level waste storage tanks but to provide for major waste immobilization facilities as the appropriate step in moving towards geologic repository disposal. The level of activity in the DWTM program is increasing, requiring additional funding, due to the approaching completion of major facilities and the shift from storage to disposal operations. At the Savannah River Plant, we plan to step

up preoperational activities at the Defense Waste Processing Facility (DWPF), which is approximately 50 percent complete. The Waste Isolation Pilot Plant (WIPP), which is approximately 80 percent complete, requires additional funding to complete construction and to meet operational requirements. In FY 1988, we have provided funding for initial design activities on the Hanford Waste Vitrification Plant (HWVP). These facilities are all a part of the Defense Waste Management Plan submitted to Congress in June 1983.

(Chart 1) The Nuclear Materials FY 1988 and 1989 request is $2.69 billion and $2.99 billion, respectively. The FY 1988 amount includes $1.88 billion for Nuclear Materials Production, and $0.81 billion for Defense Waste and Transportation Management. The corresponding request for FY 1989 is $2.22 billion for Nuclear Materials Production and $0.77 billion for Defense Waste and Transportation Management.

NUCLEAR MATERIALS PRODUCTION

INTRODUCTION

Goals

(Chart 2) The principal goal of the Nuclear Materials Production (NMP) program is to provide nuclear materials to meet national defense requirements. In addition, we must maintain current production capability and capacity, and at the same time continue to support essential environmental, safety, and health; and safeguards and security requirements.

Nuclear Materials Requirements

The Nuclear Materials Production budget is primarily based on the requirements for tritium, plutonium, and enriched uranium set forth in the Nuclear Weapons Stockpile Memorandum approved annually by the President. This Memorandum consists of the Nuclear Weapons Stockpile Plan for the current and next 5 fiscal years (FY 1987-1992), and a planning projection for the subsequent 5-year period (FY 1993-1997). The President annually issues a National Security Decision Directive approving the Nuclear Weapons Stockpile

DEFENSE PROGRAMS — NUCLEAR MATERIALS

FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
NUCLEAR MATERIALS PRODUCTION	$1,767.5	$1,858.4	$1,881.6	$2,220.0
DEFENSE WASTE AND TRANSPORTATION MANAGEMENT	618.0	672.2	811.2	771.0
TOTAL	$2,385.5	$2,530.6	$2,692.8	$2,991.0

CHART 1

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

PROGRAM GOALS

- MAINTAIN BASIC PRODUCTION CAPABILITY AND CAPACITY
- MEET NUCLEAR WEAPONS STOCKPILE MEMORANDUM (NWSM) AND OTHER NEAR-TERM OPERATIONAL REQUIREMENTS
- CONTINUE TO OPERATE NUCLEAR MATERIALS PRODUCTION FACILITIES IN A SAFE, SECURE AND ENVIRONMENTALLY ACCEPTABLE MANNER

CHART 2

Plan and noting the planning projection as a point of departure for future stockpile plans. These forecasts are based on projected military needs as well as DOE's ability to respond to these needs.

In addition to contributing to meeting these weapon requirements the materials production complex must also satisfy the other government and civilian demands for nuclear materials. These total requirements are met from existing inventories, new production in our facilities, and through purchase of uranium enrichment services from the DOE Office of Uranium Enrichment. I will now address the requirements for tritium, plutonium, and enriched uranium.

Tritium

The tritium in the weapons stockpile decays at the rate of about 5.5 percent per year. In order to maintain the effectiveness of these weapons the tritium components are exchanged and recycled. In addition to this recycle work, there are new weapons added to the stockpile that require tritium. (Chart 3) This next chart shows the annual new tritium which must be produced to satisfy all tritium demands, including decay and losses, through FY 1997. It is DOE policy to operate our production reactors to meet this tritium requirement before satisfying the requirements for other reactor products. (CHART 3 DELETED.)

(Chart 4) This next chart displays the annual percent of reactor production capacity which must be used to meet these tritium requirements. The remaining capacity is used to produce the plutonium which contributes to the total required inventory of plutonium. (CHART 4 DELETED.)

Plutonium

(Chart 5) This next chart shows total amount of plutonium needed to satisfy the projected requirements. The total current weapon inventory and production support pipeline contain DELETED of plutonium. The projected

total inventory required through the directive period DELETED, and the total through the planning period is Much of the plutonium required for building new warheads is obtained by reclaiming and recycling materials from the retired weapons returned by the Department of Defense (DOD) to the DOE. Material requirements which cannot be met from DOD returns or existing DOE inventories must be satisfied by new production. (CHART 5 DELETED.)

This chart also shows the total amount of plutonium expected to be available to satisfy the projected requirements. As you can see we expect to meet these requirements based on continued operation of N Reactor. The delta between the upper and lower supply lines on the chart reflect the contribution to the total available plutonium inventory based on continued N Reactor operation.

Highly Enriched Uranium

I also need to mention the supply of highly enriched uranium for U.S. weapons. The U.S. weapons program has operated within its existing inventory of enriched uranium for the last 24 years without having to obtain additional material from the uranium enrichment complex. (Chart 6) This has been accomplished by recycling enriched uranium from retired warheads and using existing excess inventories. Although recycling continues, the current schedules for building and retiring warheads will make it necessary to purchase uranium to meet requirements beginning in FY 1990. (CHART 6 DELETED.)

Production Process and Materials Flow

(Chart 7) before I get into the details of our request, I would like to describe the DOE defense nuclear fuel cycle and its associated facilities. The gaseous diffusion plants provide uranium of the proper enrichment levels to the feed material facility at Fernald, Ohio. A facility at Ashtabula, Ohio, extrudes depleted and slightly enriched uranium metal ingots provided by the facility at Fernald. The depleted uranium is returned to the Fernald

DEFENSE NUCLEAR FUEL CYCLE

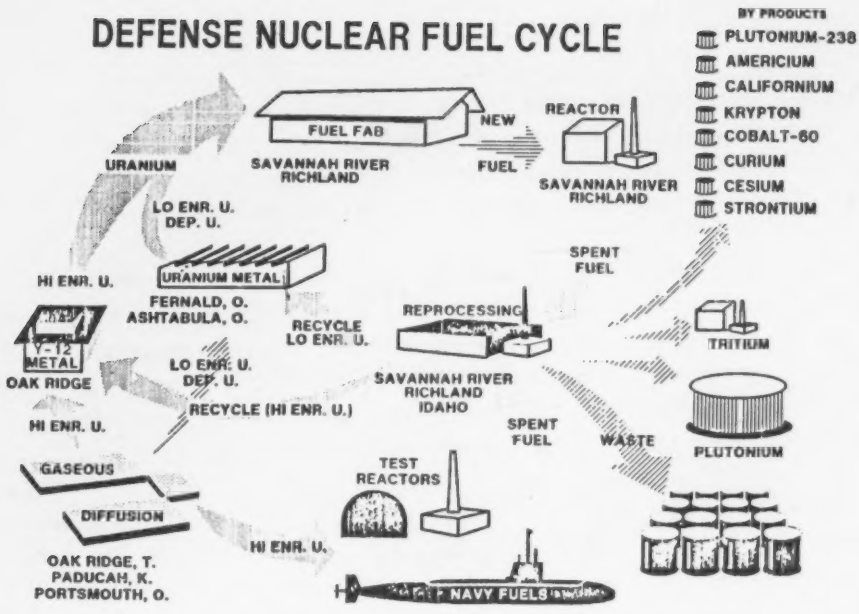


CHART 7

facility for additional processing prior to shipment to the Savannah River Plant, where it is assembled into targets for use in the reactor. The slightly enriched uranium is shipped directly from the Ashtabula facility to Richland where it is fabricated into fuel elements for the N Reactor.

Uranium fuel is obtained from four sources: (1) slightly enriched and highly enriched uranium recycled from irradiated defense production reactor fuel; (2) highly enriched uranium recovered from spent Navy and research reactor fuel at Idaho and processed into usable form at Oak Ridge; (3) highly enriched uranium stockpiled at the Oak Ridge Y-12 plant; and (4) new slightly enriched uranium obtained from the DOE enrichment plants.

Our Savannah River Plant reactors can produce both plutonium and tritium. For plutonium, the reactors use about 60 percent enriched uranium in the fuel rods to drive the reactors and irradiate depleted uranium target cores to produce plutonium.

The N Reactor at Richland uses slightly enriched uranium to fuel the reactor and produce plutonium. The spent fuel from N Reactor is processed at the Plutonium Uranium Extraction (PUREX) fuel processing plant to recover both the produced plutonium and the remaining uranium.

Idaho receives, stores, and processes fuels principally from Navy propulsion reactors for the recovery of residual enriched uranium. The recovered uranium is used as fuel for the Savannah River reactors.

FY 1988/FY 1989 Budget Request

(Chart 8) Turning now to the FY 1988 budget, we are requesting $1.88 billion in support of Nuclear Materials Production activities. This is approximately a 1 percent increase over FY 1987.

(Chart 9) The next chart shows the major reasons for changes from the FY 1987 appropriation. After adjusting for escalation, the program funding is

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES				
REACTOR OPERATIONS	$ 541.7	$ 576.5	$ 580.7	$ 630.3
PROCESSING OF NUCLEAR MATERIALS	464.8	453.1	455.7	485.2
SUPPORTING SERVICES	248.1	226.5	235.6	246.7
URANIUM ENRICHING	169.6	176.7	193.0	242.3
PROGRAM DIRECTION	22.3	22.5	24.0	25.0
TOTAL OPERATING	1,446.5	1,455.3	1,489.0	1,629.5
CAPITAL EQUIPMENT	109.5	112.3	101.4	195.4
CONSTRUCTION	211.5	290.8	291.2	485.1
TOTAL	$1,767.5	$1,858.4	$1,881.6	$2,220.0

CHART 8

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
CHANGES FROM FY 1987 APPROPRIATION
(IN MILLIONS)

FY 1987 APPROPRIATION		$1,858.4
o ESCALATION		+ 63.8
o CORE PROGRAM		
- BASE ACTIVITIES	- 82.1	
- RESTORATION AND PRODUCTIVITY RETENTION	+ 33.2	
- SPECIAL ISOTOPE SEPARATION	- 20.7	
- PROCESS FACILITY MODIFICATION	- 23.7	- 93.3
o ENVIRONMENTAL, SAFETY, AND HEALTH		+ 46.6
o SAFEGUARDS AND SECURITY		- 3.5
o NAVAL REACTOR PROGRAM SUPPORT		+ 9.6
TOTAL FY 1988 REQUEST		$1,881.6

CHART 9

declining. The only significant growth is for environment, safety, and health activities necessary to ensure future compliance with applicable State and Federal regulations. Addressing the priority need to maintain production facilities of adequate capability and capacity also requires funding over current levels. Because of the need to address these critical environmental and maintenance activities, the Nuclear Materials Production program has had to take a hard critical look at core program activities for ways of economizing or deferring lower priority activities, such as R&D reductions, construction stretch-outs, etc.

(Chart 10) The next chart shows a crosscut of our budget request broken down into important program activities. I will address each in detail.

CORE PROGRAM

Base Activities

(Chart 11) The major component of our request is for base activities. Base activities include current operating facilities that will continue to operate for the production of nuclear materials. Of the request, approximately $1.0 billion is needed to support base activities.

Meeting the objectives of the program requires operation of reactor feed materials facilities at Fernald, Ashtabula, and Oak Ridge; operation of the three Savannah River Plant reactors to produce tritium and high-purity plutonium for blending; operation of the Richland N Reactor to produce weapon-grade plutonium; operation of chemical processing facilities at the Savannah River Plant, Richland, and Idaho; ongoing technology development activities; and operation of utilities and other site support facilities. The program also supports processing of Naval and research and development reactor spent fuel returned to Idaho, recovery and processing of scrap nuclear materials to supplement new production, and other Department, government, and industry requirements.

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
CORE PROGRAM				
BASE ACTIVITIES	$1,063.5	$1,057.6	$1,014.6	$1,088.6
RESTORATION AND PRODUCTIVITY RETENTION	80.5	87.2	120.7	209.8
SPECIAL ISOTOPE SEPARATION	78.6	74.7	56.0	101.0
PROCESS FACILITY MODIFICATION	20.9	40.2	17.0	72.2
TOTAL CORE PROGRAM	1,243.5	1,259.7	1,208.3	1,471.6
ENVIRONMENTAL, SAFETY, AND HEALTH	234.3	287.5	344.4	362.5
SAFEGUARDS AND SECURITY	129.8	148.8	150.4	158.9
NAVAL REACTOR SUPPORT	159.9	162.4	178.5	227.0
TOTAL NUCLEAR MATERIALS PRODUCTION	$1,767.5	$1,858.4	$1,881.6	$2,220.0

CHART 10

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
BASE ACTIVITIES

- o MAINTAIN BASIC PRODUCTION CAPACITY AND CAPABILITY THROUGH OPERATION OF:
- FEED PRODUCTION PLANTS AT FERNALD, ASHTABULA, AND OAK RIDGE
- N REACTOR AT RICHLAND AND THREE SAVANNAH RIVER REACTORS
- PUREX PROCESSING PLANT AT RICHLAND, TWO PROCESSING CANYONS AT SAVANNAH RIVER, AND PROCESSING PLANT AT IDAHO
- SCRAP RECOVERY FACILITIES AT ALBUQUERQUE, OAK RIDGE, RICHLAND, SAN FRANCISCO, AND SAVANNAH RIVER
- SUPPORT FACILITIES AT IDAHO, OAK RIDGE, RICHLAND, AND SAVANNAH RIVER
- TECHNOLOGY DEVELOPMENT ACTIVITIES AT VARIOUS LOCATIONS

CHART 11

Savannah River Plant Reactors

(Chart 12) The Savannah River Plant reactors will be operated to produce the necessary tritium and plutonium to support the requirements of the Nuclear Weapons Stockpile Memorandum. In FY 1988 the L, P, and K Reactors will be operated at their capacity; the C Reactor will remain in cold standby due to the unrepaired cracks in the reactor tank. The fuel fabrication facilities will operate on a single shift per day to support these reactors.

N Reactor

(Chart 13) The N Reactor, located near Richland, Washington, has received a great deal of congressional, citizen, and press interest since the accident with one of the Soviet Union's graphite moderated power reactors located near Chernobyl in the Ukraine. Although there are significant differences in design, operation, and safety features between the N Reactor and the Chernobyl (RBMK-1000) reactor, both use graphite for neutron moderation and water for cooling the uranium fuel. These similarities and the heightened interest that resulted from the Chernobyl accident have led to extensive safety investigations that began immediately following the accident and are continuing at the present time. Five of the safety evaluations of N Reactor have been initiated at the direction of the Secretary of Energy and another evaluation has been conducted by the Government Accounting Office.

While the Department of Energy believes that the N Reactor can continue to be operated safely until the early to mid-1990's, the Under Secretary of Energy deemed it advisable to extend the N Reactor scheduled refueling downage to a 6 month standdown so that an accelerated safety enhancement program could be undertaken. This intent was announced publicly on December 12, 1986, and went into effect following completion of irradiation of a plutonium fuel charge on January 7, 1987. At the end of this 6 month period, N Reactor will again operate to provide the weapon-grade plutonium necessary to support mission requirements. Additionally, the Department is planning to issue an Environmental Impact Statement (EIS) on the activities associated with the safety enhancement program and expect to complete the EIS in late FY 1989.

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

SAVANNAH RIVER REACTORS

- C REACTOR PLACED IN COLD STANDBY STATUS IN FY 1987
- REACTOR SIMULATOR NOW IN FULL OPERATIONS FOR REACTOR TRAINING
- NO KNOWN LIFE LIMITING MECHANISMS HAVE BEEN IDENTIFIED FOR P, K, AND L REACTORS
- SAVANNAH RIVER REDUCED REACTOR POWER APPROXIMATELY 25% IN NOVEMBER 1986 AFTER IDENTIFYING UNCERTAINTIES IN EMERGENCY COOLING SYSTEM (ECS) PERFORMANCE EVALUATIONS
- IN COURSE OF NATIONAL ACADEMY OF SCIENCES PANEL REVIEW OF DOE REACTORS, PANEL NOTIFIED DOE ON MARCH 9, 1987 THAT THEY COULD NOT CONCLUDE WITH CONFIDENCE THAT ECS CAN WITHSTAND A SEVERE "LOSS-OF-COOLANT" ACCIDENT
- DOE DECIDED TO LIMIT REACTORS TO APPROXIMATELY 50% POWER PENDING SUPPORTING DATA FOR INCREASED POWER
- INTERIM PANEL REPORT ON PRODUCTION REACTORS EXPECTED MAY 1987

CHART 12

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

N REACTOR

- CHERNOBYL INCIDENT FOCUSED TREMENDOUS ATTENTION ON N REACTOR
- REVIEWS BY DOE AND INDEPENDENT CONSULTANTS CONFIRMED THAT A CHERNOBYL-TYPE ACCIDENT IS NOT POSSIBLE AT N REACTOR
- N REACTOR WAS PLACED IN A STAND DOWN CONDITION ON JANUARY 7, 1987, FOR A PERIOD OF APPROXIMATELY 6 MONTHS TO ALLOW FOR THE ACCELERATION OF PORTIONS OF THE SAFETY ENHANCEMENT PROGRAM
- DOE TERMINATED ACTIVITIES TO EXTEND THE LIFE OF N REACTOR BEYOND THE MID-1990'S

CHART 13

Processing Operations

Processing of the reactor fuel and targets separates the plutonium and tritium into product form for use in nuclear weapons. Processing also includes the purification of scrap plutonium that is unavoidably generated in plutonium processing operations. Plutonium is processed in a vast complex of aging facilities, each of which plays a vital role in materials production. Maintaining and upgrading these facilities for long-term operation while at the same time continuing to meet production requirements is a special challenge. With the continued support of this Committee and with the sharing of similar processing capabilities between the Office of Nuclear Materials Production and DOE's Office of Military Application to our mutual benefit, we have been able to meet materials requirements. Continued upgrading of these processing facilities and preventive maintenance will be required to maintain processing capabilities and to deliver plutonium to our weapons program.

(Chart 14) At Hanford, all plutonium processing operations were suspended on October 8, 1986, to correct some problems in authorization, control, and approval of engineering and maintenance work which contributed to violation of criticality prevention specifications. A new work authorization system has been designed, is being implemented, and all personnel are being trained in its use. PUREX was restarted in mid-February of this year. The Plutonium Reclamation Facility is expected to be restarted in April of this year. The last of the processing facilities, the metal production line, is expected to resume operation in July 1987.

Restoration and Retention

The potential for facility related production curtailments, such as those that have occurred during the past year, has been recognized for some time. Projects were initiated as early as FY 1981 to address the emerging problems of plant aging and marginal capacity.

That foreplanning paid dividends. Thanks to production increases obtained through the L Reactor Upgrade, the Restoration of Production Capabilities,

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

PLUTONIUM PROCESSING OPERATIONS AT HANFORD

- o PROCESSING OPERATIONS SUSPENDED BY FIELD OFFICE MANAGER OCTOBER 8, 1986, DUE TO CRITICALITY PREVENTION SPECIFICATION VIOLATIONS
- o REVIEWS INDICATED IMPROVEMENTS REQUIRED IN CRITICALITY CONTROL SYSTEMS, TRAINING, WORK AUTHORIZATION/CONFIGURATION CONTROL PROCESS, INTERNAL COMMUNICATIONS, MANAGEMENT SYSTEMS AND QUALITY ASSURANCE
- o SHUTDOWN WILL NOT IMPACT WEAPONS PRODUCTION
- o FACILITY RESTART ANTICIPATED:
  - PUREX - FEBRUARY 1987
  - PLUTONIUM RECLAMATION FACILITY (PRF) - APRIL 1987
  - METAL PRODUCTION LINE (RMC) - JULY 1987
- o PROCESSING FACILITIES (PRIMARILY PRF AND RMC) DO NOT MEET ALL CURRENT REQUIREMENTS INCLUDING SEISMIC; HOWEVER, ACCIDENT CONSEQUENCES ARE WELL WITHIN 10 CFR 100 REQUIREMENTS

CHART 14

and other early projects; we are able to compensate for the loss of C Reactor and the interruption of operations at Hanford.

The problem of overtaxed, obsolete facilities is, however, not solved. Additional initiatives are required if we are to continue to meet production requirements in the future.

The outyear supply projections that were shown in Chart 5 are based on the timely undertaking of a number of key projects. I would like to discuss these next.

(Chart 15) The Productivity Retention Project is directed at two of our most immediate needs: improved plant operational availability and cost efficiency. The output of many of our facilities is declining due to excess maintenance downtimes. Old, worn-out equipment breaks and requires constantly increasing levels of repair. These repairs halt operations and inhibit production. In the case of nuclear facilities, even a minor breakdown can have a significant impact because of the decontamination that must be performed prior to an actual repair.

Further, more stringent safety and environmental release regulations have come into effect since the plants were originally constructed. These standards are now forcing us to curtail, or even halt operations, and must be dealt with.

The total cost of correcting these deficiencies and improving the efficiency of our principal facilities is estimated to be $550 million. The project has been divided into five separately introduced phases in order to accommodate budget constraints. We are requesting approximately $68.9 million in FY 1988 to continue Phases I and II and initiate Phase III. Approximately $127.9 million in follow-on authorization will be needed in FY 1989.

While the Productivity Retention Project represents a substantial investment, the cost will more than be repaid through outyear savings. Without this project we will have to use high staffing levels and other noncost-effective approaches that will drive up operating budgets.

DEFENSE PROGRAMS — NUCLEAR MATERIALS

RESTORATION AND RETENTION
(IN MILLIONS)

	TEC	FY 1986	FY 1987	FY 1988	FY 1989
FACILITY RESTORATION (82-D-124)	$ 367.3	$ 42.5	$ 6.1	$ 15.4	$ 8.2
FUEL PROCESSING RESTORATION (85-D-139)	284.0	18.4	36.6	36.4	73.7
PRODUCTIVITY RETENTION (86-D-149)	356.0	19.6	44.5	68.9	127.9
TOTAL		$ 80.5	$ 87.2	$ 120.7	$ 209.8

FACILITY RESTORATION
- o COMPLETES UPGRADE OF FACILITIES TO MAINTAIN THE PRODUCTION OF NUCLEAR MATERIALS IN SUPPORT OF NATIONAL DEFENSE PROGRAMS.

FUEL PROCESSING RESTORATION
- o REPLACES DETERIORATED URANIUM RECOVERY PROCESS AT IDAHO FUELS PROCESSING FACILITY.
- o PROVIDES NEW LOW-LEVEL LIQUID WASTE TREATMENT AND DISPOSAL SYSTEM.

PRODUCTIVITY RETENTION
- o PROVIDES FOR MODERNIZATION AND UPGRADE OF EXISTING PRODUCTION FACILITIES TO INCREASE OPERATING AVAILABILITY AND/OR EFFICIENCY OF CRITICAL PRODUCTION COMPONENTS.

CHART 15

Our requested funding of $36.4 million for the Idaho Restoration project will allow the continuation of the design work and long-lead equipment procurement activities and the initiation of construction activities for the Idaho Fuel Processing Facility which was initially authorized in FY 1985. This project is required to increase capacity and ensure reliability sufficient to process the scheduled Navy fuel returns. The enriched uranium recovered at Idaho greatly reduces the amount of new highly enriched uranium required for the Savannah River Plant production reactors. A recent reevaluation of this reprocessing has shown it to be economically superior to the permanent storage in a repository of spent Naval reactor cores. The FY 1989 request of $73.7 million will allow the Idaho Restoration program to complete definitive design and begin construction of the facility substructure.

The Facility Restoration project was begun in FY 1981 and is the oldest of our three projects to maintain production capacity. It is now in the latter stages of construction. Over half of the subprojects have already been completed and, as mentioned previously, are contributing to our production output. A total of approximately $19.1 million is requested in FY 1988 and FY 1989 to complete the final subprojects.

Special Isotope Separation (SIS)

(Chart 16) The FY 1988 budget requests $56.0 million to continue research and development on Special Isotope Separation technology as well as the design and engineering associated with the production facility which was initiated in FY 1986. The request will enable testing of prototypic plant laser and separator systems directed toward the demonstration of simultaneous multi-isotope plutonium separations beginning in FY 1988.

In FY 1989, site preparation should be completed and physical construction of the proposed SIS facility is planned to begin. The total estimated cost of the SIS project is $530 million.

DEFENSE PROGRAMS — NUCLEAR MATERIALS

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
SPECIAL ISOTOPE SEPARATION
(IN MILLIONS)

	FY 1986	FY 1987	FY 1988	FY 1989
OPERATING EXPENSES	$ 70.3	$ 49.1	$ 50.0	$ 50.0
CAPITAL EQUIPMENT	4.5	1.0	1.0	1.0
CONSTRUCTION (TEC $530M)	3.8	24.6	5.0	50.0
TOTAL	$ 78.6	$ 74.7	$ 56.0	$ 101.0

- COMPLETE COMPONENT PRELIMINARY DESIGNS FOR LASER AND SEPARATOR SYSTEM
- CONTINUE OPERATION OF THE ENGINEERING DEMONSTRATION SYSTEM (EDS)
- CONTINUE FACILITY DEFINITIVE DESIGN
- COMPLETE ENVIRONMENTAL IMPACT STATEMENT
- FACILITY CONSTRUCTION WILL NOT BEGIN UNTIL COMPLETION OF KEY DEVELOPMENT ACTIVITIES

CHART 16

Process Facility Modifications

(Chart 17) Our requested funding of $17.0 million will allow the continuation of design and construction activities for the Process Facility Modifications project at Richland. This project will add the capability for processing and recovering plutonium from Fast Flux Test Facility (FFTF) fuel to the existing PUREX fuel processing facility. By 1990, FFTF spent fuel containing plutonium, DELETED will be available for processing. Much of this material can be used as feed to the SIS production facility expected to be operational in the mid-1990's or can be blended with other high-purity plutonium to meet DOE requirements for weapon grade plutonium.

In FY 1989 our request for PFM is $72.2 million, which will allow for awarding of the long-lead procurements required for a project of the size of PFM.

New Production Reactor (NPR)

Significant New Production Reactor activities were deferred several years ago. Constrained budgets in the foreseeable future and uncertainties associated with weapons material requirements were a factor in the decision to defer NPR activities. While this budget request does not include funds for an NPR, the Department is actively evaluating and analyzing options for future production facilities. The recent analysis of the WNP-1 reactor, located near Richland, Washington, as a possible production facility is one example of this effort. WNP-1 is a partially completed reactor within the Washington Public Power Supply System. Additionally, the ongoing restoration and productivity retention programs will assure the continued reliability of the Savannah River Plant reactors.

We are committed to assuring the continued availability of nuclear materials in the near- and long-term and to restoring, revitalizing, and maintaining Department facilities to meet material requirements.

PROCESS FACILITY MODIFICATIONS
(IN MILLIONS)

	TEC	FY 1986	FY 1987	FY 1988	FY 1989
PROCESS FACILITY MODIFICATIONS, RL (84-D-135)	$255.0	$20.9	$40.2	$17.0	$72.2

OBJECTIVE
- PROVIDE A CAPABILITY AT PUREX PLANT WHICH CURRENTLY DOES NOT EXIST FOR PROCESSING AND RECOVERING PLUTONIUM FROM FFTF FUEL

SCOPE
- MULTI-LEVEL STRUCTURE ADJACENT TO PUREX WILL INCLUDE:
  - CASK RECEIPT AND DECONTAMINATION
  - WATER POOL FOR FUEL UNLOADING AND STORAGE
  - SHIELDING CELL FOR FUEL DISASSEMBLY, ROTARY SHEARING, DISSOLUTION, WASTE HANDLING
  - PRODUCT BLENDING
  - PRODUCT LAG STORAGE
  - OFFGAS TREATMENT

SCHEDULE
- COMPLETE CONSTRUCTION - 9/94

CHART 17

Environmental, Safety, and Health

(Chart 18) I would like to talk about what the Nuclear Materials Production program is doing to support the Department's commitment to environment, safety and health (ES&H). The Department's continuing policy is to conduct its operations in an environmentally safe and sound manner. DOE is committed to taking actions necessary to comply with applicable environmental statutes, regulations, and standards, while providing nuclear materials required for national defense. The FY 1988 budget request of $344.4 million for environmental, safety, and health activities demonstrates this emphasis and commitment.

Compliance actions are underway to meet the requirements of the Resource Conservation and Recovery Act, the Clean Air Act, the Clean Water Act, and the Comprehensive Environmental Response, Compensation and Liability Act. In addition, the Department is currently responding to Congress' request for a study of the cost and safety effects of containing the existing production reactors versus building a new contained reactor. We expect to submit this report by the March 15, 1987, due date.

To assure efficient usage of limited resources to comply with the evolving multitude of Federal, State, and local environmental requirements, the Office of Nuclear Materials is in the process of preparing long-range plans to address ES&H concerns. The ES&H long-range plans will be updated on an annual basis to reflect changing requirements/operations and funding availability.

At the Feed Materials Production Center (FMPC), Fernald, Ohio, FY 1988 construction project efforts will: provide significant improvements in controlling water contamination; modifying and upgrading facility ventilation systems to reduce the risk of airborne contamination; and providing for the improved control of on-site activities that have potential for inadvertent contamination of personnel and the environment. DOE is aggressively pursuing assessment and planning efforts to determine needed corrective actions, a

DEFENSE PROGRAMS — NUCLEAR MATERIALS

ENVIRONMENTAL, SAFETY, AND HEALTH
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$189.7	$ 219.2	$ 243.0	$ 253.2
EQUIPMENT	$21.3	25.7	20.6	21.3
CONSTRUCTION:				
GENERAL PLANT PROJECTS	11.2	10.9	14.6	15.1
FY 1989 NEW STARTS	0	0	0	15.9
82-D-126 REACTOR SAFETY AND RELIABILITY, RL	1.8	0	0	0
83-D-148 NONRADIOACTIVE HAZARDOUS WASTE MGMT, SR	1.7	0	4.2	2.7
86-D-154 EFFLUENT TREATMENT FACILITY, SR	8.6	13.4	19.2	8.8
87-D-149 REDUCED CHEMICAL DISCHARGES, RL	0	3.1	0	0
87-D-150 RAD. LIQUID EFFLUENT TREATMENT FAC., RL	0	3.9	5.0	6.1
87-D-152 ENVIRONMENTAL PROTECTION PLANTWIDE, SR	0	1.5	2.8	2.2
87-D-159 ES&H IMPROVEMENTS, PHASES I AND II, FMPC, OR	0	9.8	35.0	37.2
SUBTOTAL CONSTRUCTION	$ 23.3	42.6	80.8	88.0
TOTAL PRODUCTION	$ 234.3	$ 287.5	$ 344.4	$ 362.5

CHART 18

schedule for implementation, and the associated funding required. Renovation activities for FMPC were initiated in FY 1982. The majority of the activities began in FY 1985 and continue through the 1980's. DOE is preparing an environmental impact statement on renovation activities to obtain public input to assist DOE in its decision making process. It is DOE's goal to comply with applicable ES&H requirements for FMPC operations and to reduce operational risk and environmental releases to as low as reasonably achievable levels.

The production complex must operate in an environmentally acceptable manner while providing the nuclear materials required for national defense. The FY 1988 budget request for ES&H activities provides for the beginning of new long-term solutions for priority problem areas.

SAFEGUARDS AND SECURITY

(Chart 19) In FY 1988, we are requesting $150.4 million in safeguards and security funding to address essential needs. Our request includes only one new project for Nuclear Materials Production, a security project at the Savannah River Plant which will provide the reactor areas with a consolidated security system. It will provide an automated access control system and consolidate all alarm monitoring and assessment functions. Modification of these systems will provide the capability to respond to increased detection, assessment, and access control needs. The new system will also improve the restriction of access to vital areas to authorized personnel.

NAVAL REACTORS SUPPORT

(Chart 20) The Nuclear Materials Production program budgets for the separative work to produce highly enriched uranium from the Department's gaseous diffusion complex for the Naval Reactors program. In FY 1988, the Naval Reactors program requires DELETED This highly

DEFENSE PROGRAMS — NUCLEAR MATERIALS

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
(IN MILLIONS)

SECURITY FUNDING

	FY 1986 ACTUAL	FY 1986 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 102.8	$ 109.1	$ 111.9	$ 115.7
EQUIPMENT	8.0	14.0	8.2	8.5
CONSTRUCTION				
GENERAL PLANT PROJECTS	3.4	5.1	4.7	4.8
84-D-134 SAFEGUARDS AND SECURITY IMPROVEMENTS, SR	6.3	11.5	9.7	11.6
84-D-137 FACILITY SECURITY SYSTEM UPGRADE, ID	4.7	0.3	0	0
85-D-137 VAULT SYSTEM, RL	1.9	0	0	0
86-D-156 PLANTWIDE SAFEGUARDS SYSTEMS, SR	2.7	8.8	13.0	11.6
88-D-153 ADDITIONAL REACTOR SAFEGUARDS, SR	0	0	2.9	6.7
SUBTOTAL CONSTRUCTION	19.0	25.7	30.3	34.7
TOTAL SECURITY FUNDING	$ 129.8	$ 148.8	$ 150.4	$ 158.9

CHART 19

NUCLEAR MATERIALS PRODUCTION
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
(IN MILLIONS)

NAVAL REACTOR SUPPORT

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
NAVAL REACTORS PROGRAM SUPPORT	$ 159.9	$ 162.4	$ 178.5	$ 227.0

[DELETED]

CHART 20

enriched uranium will be used for fabrication of naval propulsion reactor cores and to continue naval fuel production in the new facility at the Savannah River Plant. The total Naval Reactor support request is $178.5 million. The $227.0 million requested for enriched uranium for the Naval Reactors program in FY 1989 will support a level of [DELETED] a [DELETED] increase above the FY 1988 request.

SUMMARY

(Chart 21) In summary, there are a number of challenges currently facing the Nuclear Materials Production Complex, i.e.:

- o Maintaining production in aging facilities including those undergoing renovation;
- o Maintaining production with concurrent increased ES&H and safeguards and security requirements and constraints;
- o Maintaining required production levels within constrained budgets while accommodating increased ES&H and safeguards and security funding needs; and
- o Developing sufficient budget and support to begin and sustain new initiatives required to assure a viable production complex into the next century.

We are taking aggressive actions to meet these challenges and look forward to the continued close communication with and support of the Congress which is essential to the success of these actions.

DEFENSE PROGRAMS — NUCLEAR MATERIALS

CHALLENGES FACING NUCLEAR MATERIALS IN FY 1988 AND BEYOND

- MAINTAINING REQUIRED PRODUCTION IN AGING FACILITIES
- MINIMIZING IMPACT ON PRODUCTION OF EXTENSIVE RENOVATION/UPGRADE ACTIVITIES
- ASSURING CONTINUED FACILITY OPERATION IN AN INCREASINGLY PUBLIC ENVIRONMENT
- MAINTAINING REQUIRED OPERATIONS WHILE ACCOMMODATING INCREASED ES&H AND SAFEGUARDS AND SECURITY REQUIREMENTS
- PROVIDING FOR NEW INITIATIVES REQUIRED TO ASSURE A VIABLE COMPLEX INTO THE NEXT CENTURY
- PREPARING FOR TRANSITION TO PERMANENT DISPOSAL OF HIGH-LEVEL AND TRANSURANIC WASTE
- ADDRESSING REGULATORY COMPLIANCE FOR HAZARDOUS AND MIXED WASTE

CHART 21

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT PROGRAM

INTRODUCTION

Goals

(Chart 22) The Defense Waste and Transportation Management (DWTM) program's principal goal is to provide essential support for nuclear materials production requirements by responsible management of radioactive and nonradioactive hazardous wastes.

DWTM must also maintain the capability and capacity to manage defense waste in a routine, safe, and cost-effective manner. The program emphasizes techniques for managing hazardous chemical wastes and mixed wastes to meet new and evolving environmental standards, and ensuring the availability of safe, secure, and efficient means of transporting radioactive and hazardous materials.

In June 1983, the President submitted to you the Defense Waste Management Plan which provided a baseline for permanent disposal of high-level waste and transuranic waste. Our FY 1988/FY 1989 programs continue implementation of that Plan.

The key provisions of the Plan included: (1) construction and operation of the Defense Waste Processing Facility (DWPF) at the Savannah River Plant; (2) construction of the Waste Isolation Pilot Plant (WIPP) located near Carlsbad, New Mexico, and performance of research and development for demonstration of geologic disposal of transuranic waste; (3) the construction and operation of the Hanford Waste Vitrification Plant (HWVP) to process high-level waste at Hanford for disposal in a Federal geologic repository; and (4) construction and operation of transuranic waste processing facilities at Richland, the Savannah River Plant, Oak Ridge, and Idaho sites, so that transuranic waste from those sites may be shipped to WIPP.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

PROGRAM GOALS

- SUPPORT NUCLEAR MATERIAL PRODUCTION REQUIREMENTS
- MAINTAIN BASIC CAPABILITY AND CAPACITY
- CONTINUE IMPLEMENTATION OF DEFENSE WASTE MANAGEMENT PLAN

CHART 22

Implementation of the Defense Waste Management Plan requires additional operating funds in FY 1988. The completion of construction at the WIPP and DWPF facilities and the overlap of construction and operation funding requirements at DWPF and other facilities occurs primarily in FY 1988, thus resulting in increased fiscal needs at this time. I will talk about our specific site plans in just a moment.

The decision in 1983 to move from interim waste management to terminal disposal was a sound and prudent decision. Implementation of this plan, however, led to minimizing expenditures for interim waste management facilities. Timely startup of new processing and disposal facilities which will support terminal disposal, such as the DWPF, is clearly necessary to support continued production of nuclear materials.

RADIOACTIVE WASTE INVENTORIES

Radioactive Waste Types

(Chart 23) Radioactive wastes are primarily of three types--high-level, transuranic, and low-level--and are generated by DOE defense activities, the Naval nuclear propulsion program, and other DOE research and development work.

High-Level Waste

High-level waste is, in general, highly radioactive liquid waste resulting from plutonium production and enriched uranium recovery operations at the Savannah River Plant, Idaho, and Richland. Our objective is to achieve permanent disposal of high-level waste by immobilization, shipment to, and permanent disposal in a commercial geologic repository. Due to successful evaporation and concentration efforts at Hanford and the Savannah River Plant, the actual volume of stored high-level waste has been decreased by about 3 million gallons. Such efforts help to minimize the need for new interim waste storage tanks pending operation of immobilization facilities.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT

RADIOACTIVE WASTE TYPES

HIGH-LEVEL WASTE:	WASTE FROM REPROCESSING CHARACTERIZED BY HIGH HEAT AND LONG LASTING HAZARD
TRANSURANIC WASTE:	LOW-LEVEL WASTE CONTAMINATED WITH CERTAIN LONG-LIVED ALPHA ACTIVITY IN EXCESS OF 100 nCi/g.
LOW-LEVEL WASTE:	OTHER WASTE CONTAMINATED WITH SHORT-LIVED RADIOACTIVITY. INCLUDES CONTAMINATED EQUIPMENT, COMPONENTS, CLOTHING, TRASH, SLUDGES, ETC.

CHART 23

Transuranic Waste

Transuranic waste contains the long-lived, radioactive elements beyond uranium in the periodic table. The principal element in such waste is plutonium. The DOE orders allow other radionuclides to be managed as transuranic waste if the potential long-term hazards indicates that such management is warranted. The objective of the plan with regard to transuranic waste is to end interim storage and demonstrate permanent disposal in the WIPP.

Low-Level Waste

Low-level waste is radioactive waste not classified as high-level waste, transuranic waste, or spent nuclear fuel. Low-level waste is normally buried at the sites where it is generated. The Department generated and disposed of about 121,000 cubic meters of this waste during the past year.

Waste Inventories

(Chart 24) Defense Waste and Transportation Management manages the disposed and stored defense nuclear waste. The next chart shows the volume of waste that has been generated from almost 40 years of nuclear materials production activities.

We are generating increasing quantities of high-level waste in the Nuclear Materials Production program. In addition, production activities added about 6,000 cubic meters of transuranic waste during the past year.

FY 1988/FY 1989 BUDGET REQUEST

(Chart 25) I would now like to address FY 1988/FY 1989 funding needs. Our request for FY 1988 is $811.2 million, a 21 percent increase over FY 1987. The FY 1989 request is for $771.0 million.

(Chart 26) A summary of the reasons for our budget changes is shown in the following chart.

DEFENSE PROGRAMS-NUCLEAR MATERIALS

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT

Defense Waste Inventory

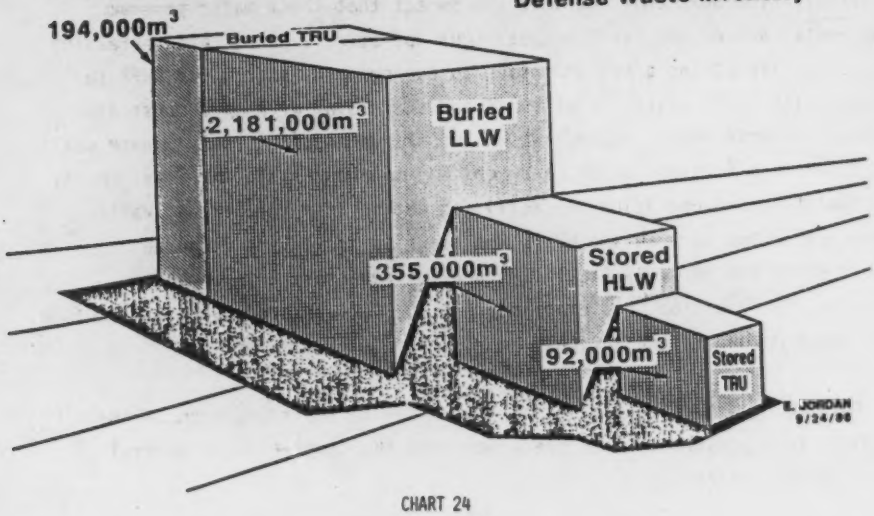


CHART 24

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
LEAD TABLE
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES				
WASTE OPERATIONS AND PROJECTS	$ 275.0	$ 329.6	$ 401.6	$ 432.0
WASTE RESEARCH AND DEVELOPMENT	73.8	69.3	53.1	60.6
HAZARDOUS WASTE AND REMEDIAL ACTIONS	18.8	23.2	27.0	28.1
TRANSPORTATION MANAGEMENT	8.9	8.5	8.4	10.7
PROGRAM DIRECTION	2.1	2.1	2.5	2.6
TOTAL OPERATING EXPENSES	378.6	432.7	492.6	534.0
CAPITAL EQUIPMENT	42.0	36.2	44.4	46.2
CONSTRUCTION	197.4	203.3	274.2	190.8
TOTAL	$ 618.0	$ 672.2	$ 811.2	$ 771.0

CHART 25

(Chart 27) The next chart depicts the impact that these major program components have on the total budget. Our operating expenses are increasing because we are adding a new dimension to our program--startup of DWPF to process high-level waste for disposal and startup of WIPP to demonstrate disposal of transuranic waste. We will continue to effectively manage wastes at all Defense Programs sites, and continue to progress in the development, construction, and operation of facilities outlined in the Defense Waste Management Plan, such as the HWVP. We are also increasing Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) hazardous and mixed waste compliance demonstration actions.

Our funding needs will decrease in FY 1989 due to the transition of the WIPP and DWPF from construction to operations and the completion of several construction projects.

(Chart 28) I have included this next chart to show funding for the major program activities within DWTM. I will now describe each of these activities in more detail.

WASTE OPERATIONS AND PROJECTS

The principal objectives of this program are the safe and environmentally sound management of existing and newly generated waste from nuclear materials, and weapons production and naval propulsion operations, and implementation of processing and disposal activities for high-level and transuranic waste. The program includes the operation and maintenance of high-level waste storage tanks, bins, and related processing and storage facilities at Richland, the Savannah River Plant, and Idaho; the operation and maintenance of low-level waste burial grounds at the Savannah River Plant, Oak Ridge, Idaho, Richland, Los Alamos National Laboratory, Sandia National Laboratory, and the Nevada Test Site; the retrievable storage of transuranic waste at various sites; and the operation of low-level waste management facilities. In addition, the program is responsible for the construction and operation of facilities to prepare transuranic waste and high-level waste for disposal.

DEFENSE PROGRAMS — NUCLEAR MATERIALS

CHANGES FROM FY 1987 APPROPRIATION (IN MILLIONS)

FY 1987 APPROPRIATION		$672.2
o ESCALATION.		+ 19.3
o WASTE OPERATIONS AND PROJECTS		
- DEFENSE WASTE PROCESSING FACILITY	+ 21.0	
- WASTE ISOLATION PILOT PLANT	+ 62.8	
- HANFORD WASTE VITRIFICATION PLANT	+ 7.5	
- OTHER OPERATIONS	+ 3.2	
- OTHER PROJECTS	+ 39.8	+134.3
o WASTE RESEARCH AND DEVELOPMENT		- 19.3
o HAZARDOUS WASTE AND REMEDIAL ACTIONS		+ 4.8
o TRANSPORTATION MANAGEMENT		- 0.4
o PROGRAM DIRECTION		+ 0.3
TOTAL FY 1988 REQUEST		$811.2

CHART 26

DEFENSE PROGRAMS — NUCLEAR MATERIALS

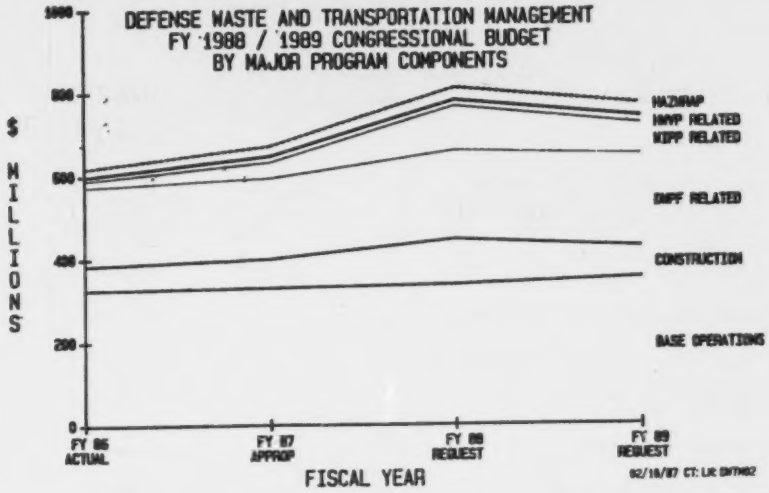


CHART 27

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
MAJOR ACTIVITIES
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
WASTE OPERATIONS AND PROJECTS				
DWPF	$ 174.5	$ 186.6	$ 210.4	$ 217.0
WIPP	4.3	22.7	86.4	51.7
HWVP	0	0	7.5	10.0
ALL OTHER	331.1	356.9	411.4	385.0
	$ 509.9	$ 566.2	$ 715.7	$ 663.7
WASTE RESEARCH AND DEVELOPMENT	76.9	71.0	54.5	62.5
HAZARDOUS WASTE AND REMEDIAL ACTIONS	19.3	23.9	29.6	31.0
TRANSPORTATION MANAGEMENT	9.8	9.0	8.9	11.2
PROGRAM DIRECTION	2.1	2.1	2.5	2.6
TOTAL	$ 618.0	$ 672.2	$ 811.2	$ 771.0

CHART 28

At INEL in FY 1988, high-level waste management activities, primarily in support of the Naval nuclear propulsion program, will continue. Planned maintenance of the New Waste Calcining Facility (NWCF) will be completed and the NWCF, which is operated on a campaign basis, will be restarted to solidify the backlog of liquid waste stored in tanks.

Construction of the Processing Experimental Pilot Plant, which will process transuranic waste prior to certification for emplacement in the WIPP, will continue. In its third full year of operation, the Stored Waste Examination Pilot Plant, INEL's transuranic waste examination and certification facility will handle 5,000 drums of waste to assure the availability of waste for WIPP when it opens in FY 1989.

Defense Waste Processing Facility

(Chart 29) Our request for FY 1988 for the DWPF operations and construction is $210.4 million. The DWPF will immobilize defense high-level waste at Savannah River for storage, transportation to, and disposal in a geologic repository. The radioactive fraction of the high-level waste will be immobilized directly in borosilicate glass. The decontaminated salt fraction of the waste will be solidified as saltstone and disposed of at the Savannah River Plant as a low-level waste. When the DWPF is operational in FY 1990, we will work off the backlog of high-level waste from production operations at the Savannah River Plant, reaching a steady-state operation in about 15 years.

In FY 1988, preoperational activities will continue at an increased pace in anticipation of FY 1990 vitrification facility operation. These preoperational activities include equipment and process development and testing; training and preparation of technical manuals; and operability testing of equipment. Also in FY 1988, construction of the DWPF saltstone facility will be completed and disposal operations will commence. During FY 1989, we will have the first full year of saltstone facility operation, and preoperational activities at the vitrification facility will continue leading to operation in FY 1990.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
DEFENSE WASTE PROCESSING FACILITY
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 16.7	$ 50.2	$ 88.3	$ 106.9
CAPITAL EQUIPMENT	1.9	3.3	1.1	2.3
CONSTRUCTION (TEC $945M)	155.9	133.1	121.0	107.8
	$ 174.5	$ 186.6	$ 210.4	$ 217.0

- RAMP-UP OF PREOPERATIONAL ACTIVITIES
- BEGIN OPERATION OF SALTSTONE PLANT
- PROVIDE OPERATIONAL AND LABORATORY SUPPORT
- CONTINUE OPERABILITY TESTING TO CONFIRM DESIGN CRITERIA
- COMPLETE LARGE-SCALE LEACHING TESTS OF GLASS WASTE

CHART 29

It is essential that the current schedule for DWPF be maintained. Double-shell tank space in which to store newly generated high-level waste is very limited, and we must continue to remove waste from the old tanks before problems develop. Delay in the DWPF project, including the start of saltstone operations, will adversely impact our ability to support nuclear materials production.

Waste Isolation Pilot Plant

(Chart 30) We are requesting $86.4 million for WIPP operations and construction in FY 1988. This is the final year of funding for WIPP. The WIPP, now under construction near Carlsbad, New Mexico, is a research and development facility to demonstrate the safe disposal of radioactive waste from national defense programs. The WIPP is authorized by Public Law 96-164 and is exempt from licensing by the Nuclear Regulatory Commission.

The primary objective of WIPP is to demonstrate the technical and operational methods for permanent isolation of transuranic radioactive waste and to provide a facility for experiments on high-level waste in bedded salt. The facility is designed to receive, inspect, emplace, and store defense waste. It will have the capability of disposing of defense transuranic waste and conducting experiments with defense generated high-level waste.

The construction of permanent surface and underground facilities started in July 1983. Much construction progress has been made. Transuranic waste is now being certified for compliance with the WIPP waste acceptance criteria and stored for eventual shipment to the WIPP beginning in October 1988. After a 5 year demonstration period, a decision will be made to leave or retrieve the transuranic waste.

In FY 1988, major project activities include completion of ventilation (fourth) shaft construction, completion of the WIPP safety analysis report and the operational readiness review, and initiation of the first TRUPACT assembly. The TRUPACT will be used to transport transuranic waste to WIPP

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
WASTE ISOLATION PILOT PLANT (WIPP)
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 12.9	$ 22.7	$ 36.1	$ 43.0
CAPITAL EQUIPMENT	8.2	0.0	14.4	8.7
CONSTRUCTION (TEC $413.3M)	-16.8	0.0	35.9	0.0
	$ 4.3	$ 22.7	$ 86.4	$ 51.7

- ISSUE FINAL WIPP SAFETY ANALYSIS REPORT
- COMPLETE FACILITY OPERATIONAL READINESS REVIEW
- COMPLETE VENTILATION SHAFT CONSTRUCTION
- INITIATE ASSEMBLY OF TRUPACT FLEET

CHART 30

for emplacement. As with DWPF, preoperational activities at WIPP will be increasing in level of activity. The activities are necessary to assure a smooth ramp-up toward full operation of the facility in FY 1989 and include environmental baseline monitoring, facility maintenance of operational subsystems, training, operational planning, and support for the State of New Mexico's Environmental Evaluation Group to assure that the concerns of the people of that State are addressed. During FY 1989, we will begin the emplacement of transuranic waste in WIPP.

(Chart 31) Included on the critical path for hot operations of WIPP in October 1988, is legislation to permanently withdraw WIPP land from public use. The legislation, drafted by the Department of Interior, is expected to be completed and submitted to Congress early in 1987.

Hanford Waste Vitrification Plant (HWVP)

(Chart 32) The proposed HWVP will incorporate high-level waste in borosilicate glass for permanent disposal in a Federal geologic repository. It serves the same function and is based on the same process technology as the DWPF now under construction at the Savannah River Plant except that an existing facility (B-Plant) will be used to decontaminate salt and process it for disposal onsite. While some refinements and testing are needed, the basic technology for vitrification of Richland high-level waste is in hand, and facility design and construction can be undertaken with confidence.

The broad scope of the Hanford defense waste EIS includes the NEPA documentation for the HWVP. The record of decision, based on the EIS, is expected to provide the basis for vitrification of high-level waste, onsite disposal of decontaminated salt immobilized in concrete, and disposal of previously separated and encapsulated cesium and strontium. The schedule is to publish the EIS and issue the record of decision early in FY 1988. The draft EIS was issued in May 1986. Nearly 2000 comments were received by September 1986, in the public participation process. Responses to the comments will be considered in a final version of the EIS by July 1987. Federal agencies and States will be briefed on the EIS in April 1987.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
WIPP LEGISLATIVE LAND
WITHDRAWAL

- CRITICAL PATH FOR HOT OPERATIONS - OCTOBER 1988
- DOI RESPONSIBILITY
  - STARTED DRAFTING JUNE 1982
  - DRAFT COMPLETE IN EARLY CY 1987
- DRAFT LEGISLATION IN OMB

CHART 31

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
HANFORD WASTE VITRIFICATION PLANT
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
CONSTRUCTION (TEC $680M)	$ 0.0	$ 0.0	$ 7.5	$ 10.0

- HWVP WILL PLACE HIGH-LEVEL WASTE IN GLASS FOR PERMANENT DISPOSAL AT RL
- SAME PROCESS TECHNOLOGY AS DWPF
- INITIATE DEFINITIVE DESIGN

CHART 32

The architect-engineer for the HWVP has been selected, and conceptual design will be completed in FY 1987. Line item project activities will begin with the start of definitive design in FY 1988. Other activities in FY 1988 include: technology development and demonstration for feed preparation, glass formulation, and equipment and systems testing; technology transfer from the DWPF project; and participation in the National program to qualify vitrification waste forms for disposal in a Federal repository.

The current plan is to begin construction in FY 1990 and commence hot startup in FY 1998. The current total estimated cost for the HWVP is $680.0 million.

Waste Research and Development

(Chart 33) The Waste Research and Development program addresses the long-term management of defense radioactive wastes. The program consists of developing technologies for each waste type and assessing the associated hazards, costs, and environmental impacts of selection and implementation of long-term disposition alternatives. We are requesting $54.4 million for this important effort in FY 1988.

High-Level Waste Technology

We are developing technology that supports the long-term management of defense high-level waste at DOE sites. Our first emphasis was support to the DWPF at the Savannah River Plant, with the emphasis shifting to the proposed HWVP at Richland. The focus in FY 1988 is on waste form qualification for acceptance at a Federal geologic repository, including large-scale leaching tests and in-situ tests of simulated high-level waste in the WIPP. At the INEL, the feasibility of volume reduction process concepts for the calcined Idaho high-level waste will be evaluated. During FY 1989 technical support to the DWPF will increase.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
WASTE RESEARCH AND DEVELOPMENT
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 73.8	$ 69.3	$ 53.1	$ 60.6
CAPITAL EQUIPMENT	3.1	1.7	1.3	1.9
CONSTRUCTION (INCLUDING GPP)	0.0	0.0	0.0	0.0
	$ 76.9	$ 71.0	$ 54.4	$ 62.5

- DWPF SUPPORT FOR FY 1990 HOT OPERATION
- SUPPORT TECHNOLOGY FOR HLW PROCESSING AT SR AND ID
- MATERIALS CHARACTERIZATION PROCEDURES AND DATA
- HIGH-LEVEL WASTE SITE TECHNOLOGY SUPPORT AT RL
- HWVP R&D, DESIGN, AND SUPPORT
- HAZARDOUS CHEMICAL DEFENSE WASTE
- TRANSURANIC WASTE TECHNOLOGY AND SYSTEM INTEGRATION
- LOW-LEVEL WASTE SYSTEM SUPPORT AND INTEGRATION
- TERMINAL STORAGE R&D AND DEMONSTRATION

Transuranic Waste Technology

The basic purposes of the Transuranic Waste Technology program are to support the demonstration of disposal of transuranic waste in the WIPP. During FY 1988, the program will: support activities needed to prepare remote-handled transuranic waste for shipment to WIPP starting in FY 1989; continue certification of contact-handled transuranic waste; complete establishment of a transuranic waste transportation system; continue buried waste immobilization studies at arid and humid sites; continue research and development activities for reducing the generation of transuranic waste in the future; initiate development of equipment for in-situ assay of buried waste and contaminated soil; and develop plans for safety evaluations of buried waste and contaminated soil.

Low-Level Waste Technology

The Low-Level Waste Technology program supports DOE waste operations for the disposal of low-level solid wastes. This program will assist disposal operations in meeting the DOE orders by increasing assurance and developing guidance for a systematic low-level waste management program. The objectives of this generic applied technology program are to: improve techniques for disposal by shallow-land burial; provide supporting documentation in assuring compliance with DOE criteria for disposal by shallow-land burial; develop cost-effective treatment processes to stabilize certain low-level waste streams; reduce volumes by generation avoidance; and evaluate disposal concepts such as greater confinement for application at DOE sites.

FY 1988 activities will include examining the role of waste forms in minimizing leaching of radionuclides from low-level waste; comparing disposal site performance with DOE requirements; documenting technical solutions to perceived problem areas; and evaluating central or regional treatment facilities.

WIPP Research and Development

The mission of WIPP is to provide a research and development facility to demonstrate the safe disposal of defense transuranic waste. To implement this, the research and development program includes: site characterizations and evaluations; impacts of heat from radioactive wastes on the salt formulation; plugging and sealing waste storage areas; performance of waste packages emplaced in salt; and evaluation of compliance with 40 CFR 191. The FY 1988 program will consist of completion of the hydrological model documentation, completion of the geohydrological report on the WIPP site; preliminary evaluation of seal design; continuation of waste package integrity studies; and continuation of performance assessment methodology development for compliance with 40 CFR 191. During FY 1989, funding to continue the FY 1988 activities will increase slightly.

Hazardous Waste Research and Development

In FY 1988, the Hazardous Waste Research and Development program will evaluate the potential of developing field demonstration programs based on research and development efforts in the areas of treatment of nitrate wastes, cleanup and reclamation of waste acids, and reduction in waste generation.

Hazardous Waste and Remedial Actions

(Chart 34) The Hazardous Waste and Remedial Actions program is requesting $29.6 million in FY 1988. This program provides support to Defense Programs on hazardous and mixed wastes and decontamination and decommissioning activities. The mission of the Hazardous Waste and Remedial Actions program is two-fold: (1) to assist the Defense Programs complex in meeting its obligations under the RCRA and the CERCLA; and (2) to either return to useful service, or otherwise safely manage or dispose of contaminated defense surplus facilities under the defense Decontamination and Decommissioning program.

DEFENSE PROGRAMS — NUCLEAR MATERIALS

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
HAZARDOUS WASTE AND REMEDIAL ACTIONS
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 18.8	$ 23.2	$ 27.0	$ 28.1
CAPITAL EQUIPMENT	0.5	0.7	2.3	2.9
CONSTRUCTION (INCLUDING GPP)	0.0	0.0	0.3	0.0
	$ 19.3	$ 23.9	$ 29.6	$ 31.0
HAZARDOUS WASTE ACTIVITIES	$ 3.6	$ 7.8	$ 12.5	$ 13.2

- PREPARE PLAN FOR IMPLEMENTING DP HAZARDOUS WASTE MANAGEMENT OPTION SELECTED UNDER THE SAS
- INITIATE MIXED WASTE DISPOSAL FACILITY AT THE NEVADA TEST SITE TO MEET RCRA REQUIREMENTS
- INITIATE DP-WIDE CERCLA REMEDIATION PLAN, BASED ON REVIEW OF CERCLA INSTALLATION ASSESSMENT REPORTS
- WIN SYSTEM FULLY OPERATIONAL WITH ALL DATA BASES
- COMPLETE DEMONSTRATION PROJECTS INITIATED IN FY 1987 AND INITIATE ADDITIONAL HAZARDOUS AND MIXED WASTE PROJECTS
- CONTINUE DEMONSTRATIONS UNDER THE INTERAGENCY SITE PROGRAM

CHART 34

Hazardous Waste Activities

In FY 1988, the hazardous waste activities are needed to meet the terms of compliance agreements and consent orders which Defense Programs sites have entered into with State and Federal regulatory agencies.

Technology support will focus on implementing a coordinated Defense Programs approach to management of hazardous and mixed wastes based on the recommendations of the Strategic Alternatives Study. The Strategic Alternatives Study is being conducted by the Office of Defense Waste and Transportation Management to examine options for management of Defense Programs hazardous and mixed wastes and to recommend a preferred approach for management of these wastes.

Information systems activities will continue to support hazardous and mixed waste technology and demonstration efforts through operation and maintenance of the DOE Waste Information Network.

Demonstration actions include permitting and initiation of construction of a low-level mixed waste disposal facility at the Nevada Test Site; initiation of projects at Hanford and Idaho to demonstrate treatment, storage, and disposal of hazardous and mixed waste in compliance with RCRA; initiation of highest priority CERCLA remedial action demonstrations at Defense Programs sites; and continuation of the cooperative Superfund Innovative Technology Evaluation demonstration program with the Environmental Protection Agency and the Department of Defense.

Decontamination and Decommissioning

(Chart 35) The Defense Programs Decontamination and Decommissioning program provides for the management of 226 radioactively contaminated surplus facilities formerly used in support of Defense Programs. In FY 1988, the program will continue providing necessary surveillance and maintenance to assure these facilities remain in a safe condition. The program will also provide for continuation of 14 ongoing decommissioning projects for surplus

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
HAZARDOUS WASTE AND REMEDIAL ACTIONS (CONT'D)
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
DECOMMISSIONING AND DECONTAMINATION	$ 15.7	$ 16.1	$ 17.1	$ 17.8

- INITIATE D&D ACTION AT MOUND SANITARY DISPOSAL PLANT
- TWO MAJOR D&D ACTIONS COMPLETED AT MOUND R-149 LABORATORY AND HANFORD STRONTIUM SEMIWORKS PROJECT
- FOURTEEN MAJOR D&D ACTIONS ONGOING DURING YEAR

CHART 35

facilities located at Mound, Idaho, Grand Junction, Oak Ridge, and Richland. Two projects will be completed (Strontium Semiworks at Richland and the R-149 Laboratory at Mound) and high priority remedial work will be initiated at the Grand Junction site for removal of uranium contamination resulting from past processing of uranium ore. These projects will reduce potential hazards and the need for surveillance and maintenance and, in some cases, make the facilities available for reuse.

Transportation Management

(Chart 36) The Transportation Management program request of $8.9 million is needed to ensure the continued safe, secure, and efficient movement of radioactive, hazardous, and other materials and property to meet Department-wide needs. This includes the development and engineering of packaging certifiable by DOE and/or the Nuclear Regulatory Commission; the investigation of concepts and technologies for future packaging and transportation systems; the maintenance and advancement of capabilities to carry out such investigations; and the establishment, implementation, and enforcement of operational policies and procedures relating to the transportation of the Department's property and materials. A corollary mission includes support for the Office of Civilian Radioactive Waste Management (RW) in related areas covered by the Nuclear Waste Policy Act. The program provides transportation and traffic management support to all DOE nonclassified programs. It assures that shipment of materials, and especially radioactive materials, is made in full compliance with Federal, State, local, and international transportation regulations.

Work includes a base technology program which has DOE-wide applicability for all DOE nuclear program transportation needs. This base technology is essential to establish and support DOE technical positions regarding regulatory provisions of packaging design, analysis, test, and operation.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
TRANSPORTATION MANAGEMENT
(IN MILLIONS)

	FY 1986 ACTUAL	FY 1987 APPROP.	FY 1988 REQUEST	FY 1989 REQUEST
OPERATING EXPENSES	$ 8.9	$ 8.5	$ 8.4	$ 10.7
CAPITAL EQUIPMENT	0.9	0.5	0.5	0.5
CONSTRUCTION (INCLUDING GPP)	0.0	0.0	0.0	0.0
	$ 9.8	$ 9.0	$ 8.9	$ 11.2

- DEVELOP AND TEST PACKAGES FOR RADIOACTIVE AND HAZARDOUS MATERIALS
  - STANDARDS, MATERIALS, ANALYTIC TECHNOLOGY
  - MODELING TECHNIQUES, SYSTEM EVALUATIONS, AND TESTS
  - SAFETY AND RISK ASSESSMENTS, TRANSPORTATION NETWORKS, LOGISTICS, AND ECONOMICS

- PROVIDE CENTRALIZED EXPERTISE AND MANAGEMENT OF DOE-WIDE TRANSPORTATION AND PACKAGING ACTIVITIES
  - TRANSPORTATION/PACKAGING OPERATIONS
  - TRAINING
  - INFORMATION PRODUCTS
  - DATA SYSTEMS
  - SATELLITE TRACKING SYSTEM (TRANSCOM)

CHART 36

The base technology program includes packaging design, development, materials investigations, standards development, testing, test facilities development, operational safety and risk analyses, EIS preparation, logistics and economic analyses, regulatory issue analyses, and data base development. These activities are conducted at the Sandia National Laboratory. Because of the close relationship of the base technology program and regulatory and technical requirements, coordination with RW regarding its packaging development program is a critical element of this work.

Repository Fee

(Chart 37) In April 1985, the President supported DOE's recommendation to use the repositories to be constructed under the Nuclear Waste Policy Act of 1982, Public Law 97-425, for disposal of defense high-level waste. Therefore, the Department is proceeding with arrangements to dispose of defense waste in the same repositories used for civilian waste. On December 2, 1986, a Federal Register Notice of Inquiry was published that solicited public comment on proposed alternative methods of calculating the appropriate fee to be paid by DOE into the Nuclear Waste Fund. The Department intends to refine the approach to calculating the fee after reviewing the public comments and use that approach to support requests for appropriations. No funding for the repository fee is included in the FY 1988 request.

Summary

(Chart 38) In summary, the DWTM budget does increase significantly. However, the Waste Operations program funding remains level, and there is a slight increase requested for the Hazardous Waste and Remedial Actions program. The major increases in program reflect the transition from interim operations to terminal disposal with the approaching completion of the WIPP and DWPF programs, and the initiation of design of the HWVP at Richland. Finally, we are not requesting funding in FY 1988 for the repository fee.

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST
REPOSITORY FEE FOR DISPOSAL OF
DEFENSE HIGH-LEVEL WASTE

- THE PRESIDENTIAL DECISION WAS ANNOUNCED IN APRIL 1985 ON USE OF A CIVILIAN WASTE REPOSITORY FOR DISPOSAL OF DEFENSE HLW
- FEDERAL REGISTER NOTICE OF INQUIRY PUBLISHED 12/2/86 ON METHODOLOGIES FOR CALCULATING FEE
- PAYMENT SCHEDULE WILL BE SET BY CONGRESSIONAL APPROPRIATIONS PROCESS
- NO FEE REQUEST INCLUDED IN FY 1988/FY 1989 CONGRESSIONAL BUDGET

CHART 37

DEFENSE WASTE AND TRANSPORTATION MANAGEMENT
FY 1988/FY 1989 CONGRESSIONAL BUDGET REQUEST

SUMMARY OF FY 1988 REQUEST

- DWTM BUDGET INCREASES BY 21%
- INTERIM WASTE OPERATIONS REMAINS LEVEL (4% INCREASE VERSUS 4% ESCALATION)
- MAJOR INCREASES REFLECT TRANSITION FROM INTERIM OPERATIONS TO PERMANENT DISPOSAL
  - DEFENSE WASTE PROCESSING FACILITY
  - WASTE ISOLATION PILOT PLANT
  - HANFORD WASTE VITRIFICATION PLANT
- SLIGHT INCREASE REQUESTED FOR HAZARDOUS WASTE AND REMEDIAL ACTION PROGRAM (HAZWRAP)
- WASTE REPOSITORY FEE IS NOT INCLUDED IN FY 1988 REQUEST

CHART 38

This completes my presentation. I shall be happy to answer any questions you may have on either the Nuclear Materials Production program or the Defense Waste and Transportation Management program.

STATEMENT OF
MICHAEL B. SEATON
U.S. DEPARTMENT OF ENERGY

Mr. Chairman and members of the Committee, I am Michael B. Seaton, Deputy Assistant Secretary for Security Affairs. It is a pleasure to appear before you today to address the Department of Energy's Security Affairs programs of Nuclear Safeguards and Security (including the Office of Classification), Security Investigations, and Verification and Control Technology, and our Fiscal Year (FY) 1988/FY 1989 budget request required to carry out these programs.

This is my first opportunity to testify before this Committee. Until my retirement on October 1, 1985, I served 23 years as a career military officer with the U.S. Air Force. In April 1985 Secretary Herrington asked me to join a team of professionals to conduct a study of the effectiveness and efficiency of the safeguards and security program at the Department's nuclear weapons and special nuclear materials facilities. This team conducted a 5-month assessment of safeguards and security and presented recommendations to the Secretary on August 30, 1985. Subsequently, the Secretary asked me to implement the recommendations. Accordingly, I retired from the Air Force and was appointed Director, Office of Safeguards and Security. Then, on October 12, 1986, I was appointed Deputy Assistant Secretary for Security Affairs, with the additional responsibility for the Offices of Classification and International Security Affairs.

Mr. Chairman, I intend to keep you informed on the activities of interest to your Committee in the Security Affairs area. I will be pleased to meet with the members of this Committee or the Committee staff at anytime.

SECURITY AFFAIRS

Security Affairs' programs play an important role in the Department's national security mission. Security Affairs' programs are the Department's cornerstone in: preventing the theft or sabotage of nuclear weapons, materials, facilities, and classified information. My office develops and implements policy for managing the classification and declassification of information. We also provide nuclear weapons systems expertise to the Intelligence Community, control proposed exports of nuclear materials technology and equipment, and provide technology and equipment necessary to monitor treaty compliance of foreign nuclear weapons programs. My office also provides technical and analytical support for DOE's role in arms control negotiations, policy formulation, and implementation.

I want to say a word at this point about the corporate commitment to effective safeguards and security, both on the part of DOE officials and officials of major contractor organizations. The Nation is indeed fortunate to have the caliber of men and women in both the Federal and contract workforces. Their dedication is critical to the Department's safeguards and security mission. The outstanding support and commitment by our protective force, major nuclear facilities, and research and development contractors surprised me as I observed it firsthand over the past 18 months. Every member of Congress and the American people shall know that we and our contractors view our nuclear safeguards and security responsibilities as a grave public trust. Our commitment matches that trust.

FY 1988/FY 1989 BUDGET

Security Affairs requests $210.4 million for FY 1988, a net increase of 9 percent over FY 1987 with nearly all the increase for Nuclear Safeguards and Security. This consists of $77.8 million for Nuclear Safeguards and Security (including $4.5 million for Classification); $32.0 million for Security Investigations; and $100.6 million for Verification and Control Technology. Security Affairs requests $255.2 million for FY 1989, a net increase of 21 percent over FY 1988, with the majority of the increase for the Verification and Control Technology Program.

NUCLEAR SAFEGUARDS AND SECURITY

The Nuclear Safeguards and Security program has three major program goals:

- To prevent the theft, sabotage, or loss of nuclear weapons and their components. This also includes special nuclear materials, the facilities that produce it, and protection for classified information;
- To provide a safeguards and security technology base that virtually all Federal agencies have depended upon for several years; and
- To support nuclear nonproliferation and national security objectives concerning the protection of special nuclear materials overseas.

As I discussed earlier, my first detailed assignment with the Department of Energy (DOE) was as a member of a Special Project Team. This team was created by the Secretary of Energy to assess the adequacy, effectiveness, and management of DOE's safeguards and security program, and to recommend actions needed to ensure that the level of protection was both effective and efficient throughout the nuclear weapons complex.

Two years ago, the other members of the team and I held extensive onsite reviews at all DOE major facilities. We conducted hundreds of interviews with senior management, staff, and security force personnel throughout the complex. We also reviewed the management and program actions that had been taken, were underway, or proposed.

In the report to the Secretary, we concluded that, overall, the physical safeguards and security systems at DOE's nuclear weapons facilities were satisfactory, and improvements were continuing to be made. In addition, recent security enhancements throughout the complex had significantly reduced or eliminated many protection vulnerabilities previously identified. More importantly, the study concluded that, while every facility had not completed its physical security system improvements, any adversary who attempts to gain control over or steal a nuclear weapon, a critical weapon component, or special nuclear material would face a high probability of failure. I believe that finding still stands.

The review identified the need for a number of management improvements. An innovative implementation plan, called "Operation Cerberus," was developed and executed to carry out these improvements. Nine task force committees were organized to work on the projects identified by Operation Cerberus. Operation Cerberus was concluded on November 1, 1986, with follow-on developments being directed by the Office of Safeguards and Security (OSS). This increased emphasis has had an immediate and direct impact on Headquarters and facility protection and further improvements are anticipated as Cerberus initiatives continue to be institutionalized in the safeguards and security program.

RECENT INITIATIVES

Before discussing in detail the specific program areas for which funding is requested, I would like to briefly discuss the status of several other initiatives the Department has undertaken to enhance our overall security operations. The DOE security forces at our fixed sites are contractor operations. They are highly motivated, provided with state-of-the-art equipment, and trained in the latest tactics and procedures.

The Department has continued to focus direct management support on top quality training for its contractor protective force personnel at the Central Training Academy (CTA) in Albuquerque, NM. During the past year, the CTA has taught courses in hostage negotiations, supervisory qualification, firearms safety, tactical response, arrest authority, and use of force. In addition, the CTA's expertise is being applied to other safeguards and security areas of concern. For example, the CTA has examined standardization and safety aspects of firearms throughout DOE facilities. In addition, another assessment is underway at the CTA to evaluate and recommend options for DOE's procurement and use of hardened vehicles. Responding to a specific need to answer the elusive question, "How much is enough?," the CTA has been providing tactical vulnerability analysis training programs designed to enhance onsite protection planning for safeguards and security improvements. The CTA has proven to be an extremely valuable asset to the Department in its short period of existence. Because of the top notch quality of its faculty, CTA advice and methods are much sought after by other Federal agencies as well as state and local law enforcement organizations.

The Department submitted a legislative initiative last year which requested that section 161.k of the Atomic Energy Act (42 USC §2201(k)) be modified in such a way as to ensure that our contractor protective force personnel would have sufficient legal authority to carry firearms and pursue a "fleeing suspect" beyond the boundaries of a DOE facility. Concerns had surfaced that section 161.k (the legal authority under which a DOE contractor protective force officer may carry a firearm and make arrests) might be insufficient in "hot pursuit" situations. The necessary amendments to section 161.k. were included in the Department of Defense Authorization Act, 1987 (P.L. 99-661).

Physical Fitness for Security Inspectors

As you may be aware, the Department issued a final rule in November 1984 which established mandatory physical fitness and medical standards for our security inspectors. This rule, 10 CFR Part 1046, sets forth minimum medical and physical fitness requirements for all DOE security inspectors which had to be met within 1 year (December 1985). The physical fitness requirements were met throughout DOE's facilities with a 97 percent success rate. This was a remarkable achievement. Thereafter, the Department issued a modification to 10 CFR Part 1046 which requires security inspectors to maintain their fitness levels by participating in locally developed physical training programs on a continuing basis. This better enables our protective force personnel to meet the requalification requirements (every 12 months), and ensures that a measurable level of fitness is being maintained. I am happy to report that this program has proven to be a great success by ensuring that those individuals assigned to protect DOE's most sensitive facilities have the ability to perform their duties under emergency conditions.

Nuclear Material Control and Accountability

The Department's initiatives and programs over the past few years to support site-specific safeguards and security improvements have emphasized large-scale, state-of-the-art perimeter intrusion detection and assessment systems, surveillance equipment, and improved guard force response capabilities. Aided by improvements in measurement technology and data analysis techniques, nuclear material control and accounting practices are now being increasingly emphasized at key DOE sites to identify improvements that will help address concerns such as special nuclear material diversion that might be masked by measurement uncertainties or falsification of data. Nuclear materials measurements and related control programs are vital to effective safeguards in meeting the needs of detection and confirmation that no diversion has occurred. The Office of Safeguards and Security is sponsoring efforts at DOE national laboratories and the DOE New Brunswick Laboratory to assure that all potential avenues of material flow across material balance areas within the DOE complex are controlled and accountability maintained.

Classified Document Control, Accountability, and Inventory Reduction Initiative

As a result of recent preliminary indications that classified document control throughout DOE needs improvement, we have initiated an internal review of practices in the control and protection of classified information and documents. Requirements for control of Restricted Data are contained in the Atomic Energy Act of 1954, as amended, and Executive Order 12065 contains requirements for control of National Security Information. Implementing procedures are set forth in DOE orders. A number of DOE sites are being visited to review controls and to gather information and data for an overall Headquarters analysis. Results will be used to identify areas for potential

improvement and to develop a strategy for continuing systematic assessment of the classified document control program.

Computer Security Initiative

The past few years have witnessed unprecedented expansion in computer technology which provides vital support to the nuclear weapons program. Past decentralized practice has resulted in wide variations in the level of security for the Department's classified computing systems. Our goal is to assure the necessary level of computer and communications security while maintaining as much ease of use as can be accommodated to facilitate the maximum productive output. One of the first management steps to bring uniformity and upgraded levels of protection will be full implementation of a new computer security program policy. This policy embraces current advances in technology and provides a reasonable approach to upgrading extant technologies and procedures in order to improve the overall efficiency and effectiveness of secure computing in the DOE complex. We have embarked on an intensive education and training program to enhance the skills of computer security personnel and computer security awareness of other personnel. This program of education and training is one of several activities of the DOE Center for Computer Security. Full implementation will include a short- and long-range national planning process which will provide the information to increase resource utilization and improve management direction.

The computer security program will continue to test and monitor the security measures being implemented on the Wide Band Communications Network. This network will provide the capability to exchange nuclear weapons information between the design, testing, and manufacturing sites. The development and

testing of the security features for the network is a continuing activity of the DOE Center for Computer Security.

As computer technology has advanced, there has been a marked increase in the requirement for the exchange of information between computers. The DOE Center for Computer Security continues to be involved in the research, testing, and monitoring of the methods and technology to provide security for this exchange. Additionally, the center is responsible for the design, development, and implementation of computerized methods for the identification and analysis of computer vulnerabilities.

Personnel Clearance Program Management Initiatives

Our personnel security program initiatives include a major effort to reduce the numbers and levels of DOE clearances. This initiative began after we determined that many individuals involved in non-Defense Programs related work had been processed for clearances at a level higher than needed for their official duties. This initiative will not hamper the effectiveness or efficiency of Defense Programs activities but will result in the proper levels of clearance being granted for all individuals who require a DOE clearance and eventually will enable us to concentrate our personnel security program resources on those individuals who actually require a clearance in connection with their duties. Concurrent with this initiative, we upgraded our reinvestigation requirements in December 1985 and now require periodic reinvestigations for all individuals who have a DOE clearance. This new requirement is being stringently applied throughout the Department, and we anticipate full compliance within the next 5 years. As this new requirement requires additional effort on the part of our personnel security staff, we have taken steps to

augment current staff at Headquarters and field offices with contractors and other agency detailees. To assure proper training in adjudication techniques and consistency in the application of our clearance criteria, we have increased our training efforts of staff, contractors, and detailees. Other initiatives in this arena include implementing, DOE-wide, the already operational classified visits control system which uses computer base transmission of classified visits requests. This is done while cross-checking the clearance information with our computer base clearance records system, and continuance of our efforts to review and update our computer base clearance records to assure timely and accurate data.

The Department has had a variety of mechanisms to address its increasing concern over an increasing potential "insider" threat. In its time, each effort has been successful; however, as our society changes and becomes more permissive, the potential for an adverse "insider" incident increases. Accordingly, the Department expanded on an ongoing effort to design a Human Reliability Program (HRP) that would assure that employees in certain identified positions continue to display sound judgment. This program addresses and reduces the increasing potential insider threat through periodic monitoring of both DOE and contractor employee reliability, and referral of potential problems to the occupational medicine and employee assistance programs for possible rehabilitation. An HRP Task Force was created to address and develop agency regulations, directives, and implementation guidelines which were staffed with Headquarters, field office, laboratory, and operating contractor personnel with expertise in a broad variety of human quality assurance disciplines. A Center for Human Reliability Studies (CHRS) was established to assist in providing specialized expertise in various fields related to the HRP

development and implementation. An informal observers group, formed from other Federal HRP-like programs, was established to share concerns about and solutions for HRP implementation problems. Our goal is to have a Departmental HRP become a reality in FY 1987.

Planning

A viable and forward-looking strategic and operational planning process is critical to assuring cost-effective application of safeguards and security within the Department. The OSS has, therefore, concentrated on expanding and formalizing its planning process. One of the more important aspects of our planning strategy is the Master Safeguards and Security Agreement (MSSA) program. The MSSA establishes a field office/Headquarters binding agreement regarding the level of protection for each of our critical facilities taking into account site- and program-specific conditions and achieving a balance between inherent risks and incremental costs associated with protection measures. Six MSSA's have been completed, and approximately 20 others will be completed this fiscal year. As a follow-on, a forward-looking 5-year planning process is currently under development by the OSS. The process is being designed to use the MSSA for each facility, which contains the acknowledged levels of risk for each target as the baseline guidance for the 5-year planning projection of needs, costs, and system performance at each facility. The MSSA program and 5-year planning process both make use of the standardized tactical vulnerability assessment program that is currently being taught at the Department's Central Training Academy.

We recognized that there is a direct correlation between the effectiveness of our safeguards and security programs and the quality of our safeguards and

security policy. With this in mind and the ongoing development of the Department's safeguards and security standards and criteria, increased emphasis has been placed on assuring that DOE safeguards and security policy is both current and all encompassing. During FY 1986 DOE orders in the computer security, operations security, security awareness, and personnel clearances areas were revised. A task force is currently being organized to further assist OSS in assuring identified policy voids or additional needed revisions to policy guidance are expeditiously handled.

Classification Management Initiatives

In support of the goal to maintain credible, up-to-date, and operationally practical classification policies and guidance, the Office of Classification's FY 1987 support activities focused on continuing active support for technical studies and analyses in such areas as inertial confinement fusion, computer codes, nuclear weapons testing, uranium enrichment, and safeguards and security. In addition, major program efforts continued for the review of sensitive nonnuclear technologies, including Strategic Defense Initiatives (SDI). Substantial progress was made in the development of classification education materials, appraisal training, and quality assurance procedures. A major new program effort was initiated to develop policy and guidance for the identification and protection of Unclassified Controlled Nuclear Information (UCNI) and other categories of unclassified controlled information. Substantial progress was made in international classification coordination efforts with the final development and implementation of the NATO ATOMAL Guide and Classification Management program.

THE BUDGET

The Nuclear Safeguards and Security Headquarters oversight program's budget request for FY 1988 is $77.8 million. Operating expenses require $73.2 million, and capital equipment $4.6 million. For FY 1989, the budget request is $83.4 million.

The safeguards and security Headquarters program strategy directly supports oversight and research and development activities. Oversight activities include: technical assistance to address vulnerabilities identified by onsite evaluations, protective force training, and nuclear materials control and accounting. Also the Office of Safeguards and Security oversees the Federal New Brunswick Laboratory. Research and development activities include a unique nationally available technology base on physical protection, materials control, and nuclear materials accounting systems. This research and development technology base is conducted by the national laboratories for application by the Department's field operations and other Federal, state, and local agencies. We appreciate past congressional support for the construction of the Nuclear Safeguards Technology Laboratory at Los Alamos, New Mexico, which we consider important to the development of improved nuclear materials control and accountability. The FY 1987 budget supported design work, but construction has been eliminated in the FY 1988-89 budgets to meet the Gramm-Rudman deficit targets and to avoid disruption of ongoing high priority work. This does not mean there is no need for the facility. Simply put, we could not afford the mortgage.

This safeguards and security request does not fund the construction, capital equipment, and operating expenses of safeguards and security systems at DOE

field facilities. These costs are budgeted for and expended by the Department's outlay programs, which include the nuclear weapons, nuclear materials production, and the civilian nuclear energy and energy research programs.

Mr. Chairman, the FY 1988 request of $77.8 million consists of the following five basic elements which I will address. These include: safeguards and security operations, technology development, international safeguards, classification, and program direction.

SAFEGUARDS AND SECURITY OPERATIONS

This category supports the Headquarters oversight mission of protecting Departmental resources, which range from completed nuclear weapons to classified documents. At the heart of the oversight program is a uniform systematic approach to safeguards and security programs which can assure that proposed solutions are both effective and efficient.

Elements in this category involve three major functions: guidance and assistance to DOE field operations for safeguards and security system improvements; oversight of the nuclear materials management and safeguards system, which provides timely data on nuclear materials production, utilization, transfer, tracking, and storage; and the operation of the New Brunswick Laboratory, the safeguards analytical laboratory at Argonne, Illinois.

Over the past few years, at no small expense, we have corrected deficiencies at DOE facilities. Field managers applied state-of-the-art, large-scale hardening features; surveillance equipment; and have dramatically improved

guard force response capabilities. I believe the Department has made DOE sites unattractive targets to any adversarial force.

In my view, we must now seek to balance the protection systems in place against outside adversaries with an effective program against the "insider." We must now undertake the difficult chore of protecting these critical national assets against potential perpetrators who may actually have access to our facilities. It is not pleasant to talk about. I do not like it, but, like it or not disaffected or disgruntled employees, visitors, and assignees do exist. Because these elements exist, we must have programs to deal with them. We are pursuing several major management initiatives that comprise an integrated protection program against insiders. Key elements include: personnel clearance, human reliability, physical protection, information and document control, operations security, security awareness and education, intelligence community liaison, foreign travel/alien visits and assignments, and nuclear material control.

I have already touched upon initiatives in personnel clearance, human reliability, elements of physical protection, and document control. In recognition of the hostile intelligence threat to classified or sensitive unclassified DOE technologies or facilities, we will continue to maintain a strong operations security, or OPSEC, program. OPSEC is a key ingredient in our overall security protection program and is fully integrated both at Headquarters and all field elements. The Office of Safeguards and Security (OSS) has provided sufficient training for field personnel to conduct their own OPSEC vulnerability assessments and this process is well underway. Identified vulnerabilities are analyzed, countermeasures are developed, and their implementation is

prioritized all at the local level. The OSS ensures the effectiveness of this program through an oversight management process.

We will continue to operate and expand our Security Education and Awareness program. This program was substantially improved in FY 1987 through revised policy establishing new requirements to strengthen the DOE program and implement new national policy. FY 1988-89 expansion will include analyses in such areas as the human reliability program, foreign travel and visits and assignments activities, and insider and outsider threats, to determine appropriate changes which may be required in Security Education. We will continue conducting workshops and seminars, and providing educational materials throughout the DOE.

The Department has implemented NACSI 5004 in the TEMPEST program and will continue to control compromising electromagnetic emanations through a variety of countermeasures, including the use of zone tests. We will also continue the development of advanced technical surveillance countermeasures and suppression technology in support of the Intelligence Community technical security operations.

Central Training Academy

Advanced special weapons and tactics training, with a particular focus on realistic tactical situations, continues to be a critical ingredient in improving the capabilities of our protective forces. We are using our Central Training Academy (CTA) to provide uniform training standards and to improve supervisory effectiveness throughout DOE. The CTA instills a uniform and professional approach to protective force training in the tactical, operational, and technical aspects of physical security. The curriculum at the CTA

will be expanded in depth and scope to certify instructors and training officers, to train tactical vulnerability assessment officers, and a variety of other security discipline subjects and functions not being taught outside the Department of Defense. In FY 1985, the CTA provided training to about 1,300 DOE employees and contractor personnel. In FY 1986, training was provided to approximately 2,800 individuals, while in FY 1987 we project training for 1,800 personnel. The reduction in FY 1987 reflects completion of the initial round of training to implement DOE policy on arrest authority and use of deadly force.

Nuclear Material Management and Safeguards System

We will continue to operate the DOE's Nuclear Materials Management and Safeguards System, supported jointly with the Nuclear Regulatory Commission. This system, the Nation's single nuclear materials computerized data base, is used to track nuclear materials in the United States and to record the shipment of nuclear materials to and from foreign countries. Each year, approximately 78,000 nuclear material transactions (e.g., approximately $10 billion in nuclear shipments, receipts, and inventory changes) from 130 contractors and about 900 licensees are entered into this system and tracked.

New Brunswick Laboratory

This budget funds the New Brunswick Laboratory (NBL) which serves as the U.S. Government standards laboratory for nuclear materials measurements. NBL also provides control and accounting services to DOE field offices and contractors in order to fulfill safeguards requirements. Its functions include: measurement services in support of Government audit and inspection requirements; assessing and evaluating measurement technology in support of DOE fuel cycle and weapons production activities; developing, certifying, and distributing

reference materials for calibration and standardization of materials measurements; and assisting in technology exchange and training in measurement technology.

TECHNOLOGY DEVELOPMENT

Technology development continues to be an integral part of our safeguards and security program since advanced technology is necessary for better control and accountability of nuclear materials, better physical protection techniques, and other protection techniques. Research and development (R&D) conducted by the national laboratories provides DOE with a technological base for developing new systems for safeguarding the Department's nuclear facilities and materials. Results of these efforts are also made available to the Nuclear Regulatory Commission and its licensees, as well as other Federal agencies.

Before I detail what we are doing in our small R&D program, I want to indicate that I see a problem developing because of fiscal constraints that could cause serious erosion (and in fact loss) of the security technology hardware and manpower base at Sandia National Laboratories. Unless the trend of the past 4 years is reversed, DOE facilities requiring improvement and other departments and agencies that have been depending upon this unique national laboratory expertise will find themselves powerless to quickly (or completely) replace what is steadily being lost due to funding shifts and constraints. From FY 1984 through FY 1987, Sandia funding has been reduced by over 50 percent.

Even though our research and development activities are coordinated with other agencies, the Nuclear Regulatory Commission and the Department of Defense, in particular, through the Safeguards and Security Steering Group and staff-level

liaison, the technology erosion problem will get worse unless we rebuild the technology base and urge other agencies that are benefiting to increase their share of funding. Joint research efforts of mutual benefit are identified in order to reduce the costs of such activities to each agency, and we will continue to emphasize this coordination of research and development to further minimize costs.

An integral element of the R&D planning, programming, and budgeting process is assessment of near-term and future risks, with the aim of investing in a development strategy that keeps risks at an acceptably low level. Such an assessment must take into account the spectrum of threats (i.e., the full range of characteristics and resources as opposed to separate focus on the "outsider" and the "insider"), including the trends and directions of change in the threats. DOE has taken steps to improve the leverage of R&D and the technology base for enhanced capability to mitigate the threat to DOE facilities. These steps encourage preplanned and affordable improvements. The basic strategy for R&D is a program that: (a) is oriented to user needs; (b) is relevant to DOE safeguards and security objectives and overall policy; and (c) minimizes the cost of implementing safeguards and security systems.

In addition to solving a problem and enhancing safeguards and security capabilities, evaluation criteria includes a factor that a proposed R&D project (user-need statement) should offer potential reductions in operational outlay ("crosscut") budgets for safeguards and security. Proposed R&D projects must meet the evaluation criteria to be given a high priority for funding. This provides an incentive and leverage to improve both effectiveness and efficiency of the overall safeguards and security mission, and requires close

coordination with outlay programs and designs to influence and provide timely performance expectations and cost-effectiveness for new DOE facilities and processes.

INTERNATIONAL SAFEGUARDS

Our international safeguards program supports U.S. nonproliferation and national security objectives to minimize the proliferation of nuclear weapons. The activities of program staff and contractors are required by the Atomic Energy Act of 1954, the Nuclear Non-Proliferation Act of 1978, the Omnibus Diplomatic Security and Anti-Terrorism Act of 1986 and implementing Executive Orders and Presidential directives. The primary objective is to strengthen international safeguards and physical protection through technical support to the International Atomic Energy Agency (IAEA) and cooperative efforts with other nations. Research and development will continue on new and improved technologies and systems for IAEA safeguards, including efforts on safeguards for reprocessing plants and for mixed-oxide (plutonium and uranium) fuel fabrication plants. These efforts reflect the increasing use of plutonium as fuel in civil nuclear fuel cycles. An important aspect of our research and development is increased bilateral cooperation, including technical exchanges with the Federal Republic of Germany, France, and the United Kingdom, as well as the inspectorate of the European community. These bilateral efforts optimize the research and development efforts of the U.S. and other nations through exchanges of information, staff, and equipment on international safeguards and physical protection of nuclear materials. Additionally, the application of the atomic vapor laser isotope uranium separation (AVLIS) process for enrichment introduced a new requirement for development of international safeguards methods and equipment for use with AVLIS under the

U.S./IAEA agreement for the application of international safeguards in the U.S.

Beginning in FY 1989, increased funding will be required to permit resumption of deferred R&D and the establishment of nonproliferation safeguards cooperation with Japan, Argentina, and Brazil. This increase in funding will also permit the Department to continue its responsibility to train foreign personnel in the most advanced safeguards and physical protection techniques.

Compliance with international agreements and nonproliferation objectives requires that we monitor certain international shipments of U.S.-origin materials and tracking of foreign origin materials in the U.S. Other continuing activities include recording exports, imports, and transfers of materials of foreign origin in the U.S.; reporting to the IAEA under the U.S./IAEA Safeguards Agreement and other agreements; and determining inventories of nuclear materials for bilateral agreements for cooperation.

CONSTRUCTION

The Nuclear Safeguards Technology Laboratory (NSTL) ($10.6 million TEC) that was to be located at Los Alamos would have improved our research and development effort in the safeguards and security technology area. In FY 1987, an appropriation of $1.0 million provided for building design and construction of an access road. This project has been eliminated from our request due to funding constraints.

PROGRAM DIRECTION

Our program direction supports a total of 146 Headquarters full-time equivalent positions, which includes the staff for the classification program.

CLASSIFICATION

The FY 1988 request for the Classification program, which is incorporated in the Nuclear Safeguards and Security program budget, is $4.5 million. The FY 1989 Classification program will continue at the FY 1988 level of effort. The Office of Classification manages and implements the Department's program for the classification, declassification, and control of information in the interest of the national security.

The FY 1988 request will continue active support for the review of potentially sensitive DOE research and development activities, as directed by National Security Decision Directive-189 (NSDD-189) and for classification development and oversight activities in program areas involving sensitive technologies including Strategic Defense Initiatives, nuclear testing, and other nuclear weapons areas. In addition, international coordination efforts will continue with the implementation and monitoring of NATO ATOMAL classification functions. Efforts will continue on policy development for the identification and protection of Unclassified Controlled Nuclear Information and other categories of unclassified controlled information, as well as concentrating guidance development efforts in such areas as computer codes, isotopes separation, and safeguards and security. Support will be provided for enhancement of classification education and training efforts. Efforts will continue on expanding operation of a computer data base of classification guidance. Continuing support will be provided for Classification's appraisal, quality assurance, and document review programs.

SECURITY INVESTIGATIONS

The FY 1988 request for personnel security investigations is $32.0 million. Background investigations are required by the Atomic Energy Act of 1954, as amended, and by Executive Orders 10450 and 10865. The Department is not permitted to conduct its own investigations; hence, we rely on and reimburse the Federal Bureau of Investigation (FBI) and the Office of Personnel Management (OPM) for conducting investigations of DOE employees, contractor employees, and consultants assigned to critical sensitive positions prior to their being granted access to classified information, classified materials, or special nuclear materials.

In order to have efficient program management and be consistent in meeting security requirements, we use this single program to meet the strict requirements of the Atomic Energy Act of 1954 to ensure that granting access to classified information, classified material, or special nuclear material will not endanger the common defense and security. Most background investigations directly support Defense Programs since the Department believes any clearance or access determination is directly related to protecting the common defense and security. The DOE is currently reviewing access authorization levels and lowering many Q-"Sensitive" access authorizations requiring an FBI reinvestigation to Q-"Nonsensitive," requiring an OPM reinvestigation.

During the last year, the OPM has made a significant effort in reducing the time required to conduct a background investigation. OPM is currently completing new investigations in approximately 110 days. OPM has recently obtained approval to hire an additional 180 investigators. With the additional investigators and the close out of their private sector contractor

investigator effort, OPM hopes to reduce the investigative times to 90 days during FY 1987.

The additional investigators will allow OPM to meet the demand for additional investigations required under the revised DOE Selective Reinvestigation Program requirements. These requirements, which the DOE is in the process of implementing in FY 1987, stipulate that all individuals who have a DOE clearance must be reinvestigated every 5 years. Of course, the scope of the reinvestigation will depend upon the level of clearance held by the individual. Based upon the current number of individuals who have an active DOE clearance and who have not been reinvestigated in the last 5 years, about 97,000 reinvestigations must be conducted over the next 5 years. We plan to request about 20,000 reinvestigations per year for the next 5 years to comply with our new requirements in addition to the investigations that will be scheduled for initial clearance action and for reinvestigation in the normal course of program operation.

Our FY 1988 budget request provides for 29,426 initial full-field investigations and National Agency Checks with Credit (FBI-1,000, OPM-28,426) and 11,000 reinvestigations. In FY 1989, the full-field investigations will remain at FY 1988 levels and reinvestigations will increase by approximately 12,600.

SAFEGUARDS AND SECURITY CROSSCUT

As I mentioned earlier, the DOE outlay programs fund safeguards and security activities at the Department's field facilities. Total safeguards and security funding is approximated in the Department's crosscut estimate, which

is a rough summation of all safeguards and security items in the Department's program requests, including the budget for the Office of Safeguards and Security. The crosscut estimate for FY 1988 totals $809 million, with $702 million as the defense activities portion.

As the Departmental coordinator for all DOE safeguards and security activities, Security Affairs has a range of responsibilities for safeguards and security crosscutting activities which include ensuring that program budget submissions properly reflect judgments that have been made with respect to security considerations. For example, the major construction upgrades at critical nuclear weapon facilities, such as Savannah River, Pantex, and Oak Ridge, which provide enhanced integrated protection programs against the Department's defined threats, were fully coordinated with and recommended for approval by Security Affairs. We validate the need for safeguards and security improvements, evaluate proposed upgrade designs for adequacy, and verify the performance of the upgrades once they are in place. This process is critical if we are to assure continued protection system progress in upgrading our critical facilities, and effective safeguards and security integration. Significant progress has and continues to be made towards increasing the level of protection of our facilities and the protection of DOE assets. A good portion of this has been accomplished through guard-intensive, quick-fix measures. The validation of major construction projects designed to provide long-term permanent corrective action to vulnerabilities is critical to assuring effective safeguards and security integration and the replacement of existing systems with more state-of-the-art hardware and software protective measures. If this is not accomplished and supported, our safeguards and security program will be in jeopardy.

I would now like to discuss the FY 1988/FY 1989 budget request for Verification and Control Technology.

VERIFICATION AND CONTROL TECHNOLOGY

The Verification and Control Technology (V&CT) program within DOE contains both technical and policy elements. Perhaps the most common thread among the policy program elements is the requirement for flexibility necessary to focus the resources of each program element upon immediate or near-real-time issues. The technical research and development program is the basis for much of the United States' arms control treaty verification capabilities related to nuclear issues.

Program Detail

The Office of International Security Affairs provides staff and programmatic management for the international security functions of current and potential arms control treaty verification and nuclear nonproliferation controls. These functions include:

o The development of verification technology and production of systems to monitor foreign nuclear explosions to verify compliance within treaties that constrain such explosions, and to monitor foreign nuclear activities. This activity supports:

- Development of administration policies toward verifiable arms control treaties,
- Technical guidance for arms control negotiations,
- Confidence building measures,

- Cooperative, onsite monitoring, and
- National technical means (NTM) of verification for the Intelligence Community.

o The control of nuclear and energy-related exports and the transfer of strategically significant technologies in accordance with legislative mandates and U.S. national security and nonproliferation policies.

The objectives of the arms control program of applied research and policy support are: to continue to support interagency and international policy deliberations and negotiations, to provide programmatic support for improvement of arms control techniques and approaches, and to maintain the capability to supply technical support in the arms control arena. To meet these objectives, our work program is divided into three categories: studies and analyses of current active issues, studies directed toward future issues, and quick-reaction response to current issues. The in-house staff and selected expertise from the National Laboratories and contractor support allow us to bring to bear the best expertise in the nation on problems associated with these issues.

Arms Control Program

Among the most important policy activities is the implementation of the Administration's arms control policies as communicated in the President's National Security Decision Directives and other sources. Other sources include arms control policy deliberations and U.S./Soviet arms control negotiations and technical discussions. The Office of International Security Affairs (OISA) provides both policy and technical experts to U.S. strategy

option deliberations, bilateral and multilateral negotiations and technical meetings.

The overall objective of OISA's verification research and development is to provide both technical and policy support to the national security needs for arms control, verification, and intelligence. This is accomplished through a program of long-term technical research and development of technologies, development of equipment and methodologies to support near-term verification requirements, and resolution of technical issues. The program contributes to both the development of improved national technical means of verification and onsite monitoring techniques to assist in verification of compliance with arms control treaty constraints.

Included in the development of improved national technical means are techniques for the detection, identification, characterization and location of nuclear explosions in all environments: underground, underwater, in the atmosphere and in outer space. The onsite monitoring activity, among other things, also develops the capability to monitor compliance with the yield constraints of the Threshold Test Ban (TTB) and Peaceful Nuclear Explosions (PNE) Treaties. Discussions are underway with the Soviets concerning possible changes to the Threshold Test Ban Treaty to include onsite monitoring. Should these discussions be successful, the uncertainty of yield estimates of Soviet underground explosions could be reduced significantly. The DOE's role in this area is defined in National Security Decision Directives (NSDD) 51, 63, and 81. These Presidential decision memoranda direct that the verification community take policy and technical actions designed to improve the verification of treaties limiting underground nuclear testing. The Verification and

Control Technology (V&CT) program is charged with providing modern equipment, manpower, expertise and a full range of capabilities to permit the U.S. to fulfill its PNE and TTB Treaty verification responsibilities. DOE has developed and evaluated hydrodynamic yield measurement (Continuous Reflectometry for Radius versus Time Experiment, CORRTEX) as a monitoring technique. CORRTEX would be combined with a complementary local seismic network and a trained personnel cadre for onsite monitoring. This program is also responsible for support of the Joint Technical Experiment with the USSR related to onsite monitoring proposed by the President in 1984, should we reach agreement with the Soviets for implementation of such a program.

Seismic verification continues to focus on the detection, identification, location, and characterization of underground nuclear explosions, emphasizing regional rather than teleseismic monitoring. Our program is working on in-country seismic R&D for developing seismic verification capability at regional (short-range) and local distances. This emphasis is to ensure that DOE can fulfill any national decision to provide equipment and systems to support U.S. verification of any future treaties. An example of technology developed under our program is the regional seismic array approach that is embodied in the Norwegian Regional Seismic Array. The objective is to reduce the error range of yield estimates of nuclear tests DELETED by using additional regional arrays, in support of more effectively verifiable arms control agreements. A Deployable Seismic Verification System (DSVS) is in work. Any future treaties that further constrain nuclear testing will depend on such a capability to assure the USSR's obligations are being complied with.

In addition to its verification efforts for treaties constraining nuclear explosions, the program develops gaseous and particulate radioactivity monitoring systems for sample/debris detection and analysis activities. Collection and analysis of fresh radioactive debris provides the only unambiguous evidence of clandestine nuclear activities, an area of increasing concern in the current environment where third-world countries are developing their nuclear capabilities. The result of this effort will be monitoring facilities with high sensitivity, onsite analysis, and real-time telemetry of data provided to a central monitoring facility.

Other monitoring activities include research and development of means for detection, other than optical and seismic, of nuclear detonations. Seismic nuclear explosion verification activities are long standing and seem to be approaching maximum levels of capability for any particular seismic range. Nonseismic means of detecting nuclear explosions - especially for a possible lower yield threshold - are essentially nonexistent. Because of the vast area of the Soviet Union that is seismically active and the potential for treaty evasion that activity offers, other technical means of monitoring nuclear explosions require investigation. These means would complement existing or developmental seismic verification capabilities.

Directed energy weapons (DEW), both ground-based and in space, are of increasing interest. DELETED

DELETED Some of their DEW's may employ nuclear-driven devices. Therefore, research must be conducted on techniques for monitoring these activities. These monitoring activities are the result of the demand for technical intelligence on Soviet experimental and/or operational systems using

SDI-type technology. Our program supports documented requirements for characterization of all DEW systems; and, as a natural outgrowth of these characterizations and our laboratories' expertise in these disciplines, sensors, systems, and data handling, processing, and analysis capabilities are being developed.

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Our program activity also supports national verification technology. Technology includes the fabrication of equipment (sensors and systems), and analysis and data reduction and evaluation. We also seek to define new systems, for example, those that might be required for monitoring DEW activities as discussed above.

Under the satellite instrumentation program, we fabricate satellite sensor payloads and participate in the national effort that uses satellite-borne sensors to monitor the atmosphere and space for nuclear explosions. Satellite-borne sensors provide monitoring of compliance with the Limited Test Ban Treaty (LTBT) and also support intelligence data collection on potential proliferating nations and on nuclear weapon states that are not LTBT signatories. The DOE laboratories, under contract to the Air Force, also provide the systems and capability to detect and locate multiple atmospheric nuclear bursts in a battle management situation.

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These DOE-produced sensors provide worldwide surveillance and intelligence monitoring of atmospheric and exoatmospheric nuclear explosions to deter clandestine testing by the Soviet Union, or

by nations developing a nuclear weapon capability.

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The DOE's responsibilities in export control and technology transfer follow from statutory requirements and Executive Orders. The DOE is one of a number of agencies involved in the regulation and control of technologies, material, facilities, and component exports that relate to U.S. material security and nonproliferation interests. In addition to providing operational support to other agencies in the export licensing process, OISA authorization is required on DOE authorized transfers and licensed exports by the Nuclear Regulatory Commission, Department of Commerce, and Office of Munitions Control. In this connection, OISA must maintain the capability to review and process in a timely fashion more than 10,000 export license applications annually in support of the Department of Commerce.

In the area of transfer of sensitive nuclear technology, OISA has developed and implemented revised procedures and orders for processing foreign national visits and assignments and will continue to review these requests as well as foreign travel of DOE and DOE contractor personnel to sensitive areas. OISA will also continue the support revision of the Militarily Critical

Technologies List (MCTL), with special emphasis on SDI-related technologies. We will also continue to participate, as required, in the interagency working groups, committees, and panels that address the technical and policy issues associated with technology transfer.

PROGRAM INITIATIVES

The budget request for FY 1988 ($101M) is 4% greater than the V&CT budget for FY 1987 ($97M). The FY 1989 budget request ($132M) on the surface appears to represent a major growth in the V&CT budget. In fact the $31M increase actually contains only a 6.5% increase in the FY 1988 budget. The remaining $22.5M (93.5% of $31M) supports initiatives in verification and control technology activities in support of arms control initiatives.

This technology development which supports arms control initiatives is only possible on this time scale due to the depth of capability within the V&CT program. The onsite verification effort planned for FY 1989 builds upon the hydrodynamic yield measurement experiments and computer modeling that have been a part of the verification efforts over the past several years. Specifically, this work is planned ($3.2M) to address the problem of reducing the estimation error range deriving from the CORRTEX measurements. This directly supports the Nuclear Testing Experts meetings in Geneva and negotiations for improvements in the yield estimates of underground nuclear explosions.

The Department through the V&CT program has an ongoing, long-term R&D effort in explosion seismology. This has supported the national capability to detect, identify, locate, and characterize underground explosions. The new initiative in seismic verification while not directed explicitly at the

present discussions of Threshold Test Ban Treaty can be vital for in country reduced yield agreements in the future. The V&CT program has developed and engineered deployable systems in the past to support verification of treaties constraining nuclear explosions. These have included the in-country regional seismic system developed during the Carter Administration's negotiations for verification of a Comprehensive Test Ban Treaty and a local seismic network to support the Protocol to the Peaceful Nuclear Explosions Treaty.

The in-country regional seismic network was designed a decade ago. Hence its capability is fixed by the technology that was available at that time. In early FY 1986 the V&CT began planning and programming for a deployable, state-of-the-art seismic system, called the Deployable Seismic Verification System (DSVS). The DSVS program underscores deployability using off-the-shelf proven technology. Presently the V&CT program is designing and initiating fabrication of such a DSVS. The FY 1989 budget is designed with a significant input to this effort ($9.2M) in order to make significant progress.

Since the signing of the Threshold Test Ban Treaty and the Peaceful Nuclear Explosives Treaty, the DOE has had the responsibility of supplying equipment, capability, operations plans and personnel to meet the U.S. obligations for onsite verification fixed under the protocols of those treaties. During FY 1988, the V&CT program will conduct an exercise at the Nevada Test Site which will utilize the equipment, demonstrate capability and train the cadre of U.S. personnel.

An integral portion of the efforts within the V&CT program consists of exploratory studies evaluating the possibilities of advanced verification

technologies. These include the exploration of the application of specific physics, for example, infrasound and radar monitoring, development of new instrumentation, and evaluation of advanced means of data interpretation. These efforts are possible because of the technical capabilities of the national laboratories. The increases in the FY 1989 budget for advanced concepts in verification ($3.8M) will support a number of initiatives for preliminary investigation at the national laboratories.

The V&CT program continues to make investments in research in order to increase future capabilities in verification technology. These research activities are pursued without the constraint of delivering a system to a specific user or meeting the requirement for verification of a specific arms control treaty.

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The program initiatives that have been described here are those that will have significant impact on budget formulation. In FY 1988 and FY 1989 these all fall within the development of verification technology and production of systems to monitor foreign nuclear activities and to verify treaty compliance. Additionally, the program has a number of new initiatives relative to the

control of nuclear and energy-related exports and the transfer of strategically significant technologies. These, however, are not described here as budgetary impacts because they are small.

This completes my statement. I will be happy to respond to any questions.

Senator EXON. Let me ask you this. First things first, Admiral. On the chart that you had of all of those laws, you pointed out that they were passed and that you would go to jail if they are not enforced.

I am sure it was written into the law that you would go to jail and not me, is that right?

Admiral FOLEY. I would yield to your interpretation, sir. [General laughter.]

Senator EXON. That was a very good presentation.

Shall we listen to the second witness and then go to questions, Senator? What is your pleasure?

Senator THURMOND. That would be all right.

Senator EXON. It was a very fine presentation. I think you had our very good attention, Admiral, and thank you.

Senator THURMOND. Admiral, we are very glad to have you in this position. I feel our country is fortunate to have you just where you are.

Admiral FOLEY. Thank you very much, sir.

Senator EXON. Dr. Barker, please proceed.

STATEMENT OF HON. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY, AND STAFF DIRECTOR TO THE NUCLEAR WEAPONS COUNCIL

Dr. BARKER. Gentlemen, I am pleased to be here this morning on behalf of the Department of Defense in support of the Department of Energy's budget request.

Senator THURMOND. Speak a little louder, please, so that we can all hear you.

Dr. BARKER. Yes, sir.

I am pleased to be here representing the Department of Defense in support of the Department of Energy budget, a very, very important contribution to this country's national security.

I don't want to take too much of your time, but I do want to touch upon a few issues which I think are of special importance to the Defense Department with respect to Department of Energy activities.

If I could have the first viewgraph, please.

MAJOR ISSUES

The cornerstone of our deterrent posture is, and will be for the foreseeable future, our nuclear weapons capability.

Fiscal responsibility and cost discipline is fundamental to the nuclear warhead procurement process.

We must maintain a vigorous RD&T effort in the traditional DOE program, while supporting DOE SDI-related activities consistent with DOD milestones.

Modernization of the stockpile, including modern safety and security, is only one-third complete and must be continued.

Nuclear testing is an integral and essential part of our deterrent posture.

These are five major points. I will pause for a moment and let you read them. [Pause.]

Let me now touch upon each of those five points for just a few minutes.

It is no secret to you gentlemen, you who are here, that nuclear weapons are our deterrent. Not only do they deter strategic attack; they also are intended to deter conventional aggression by the Soviet Union within the European theater and elsewhere in the world.

Deterrence has a fairly impressive track record. We have never seen a period so extensive in Europe without a major nuclear conflict. I think it is common wisdom that, indeed, we are able to do the job of deterrence in Europe at a lower cost than we could with conventional weapons alone.

Neither the hope for an ultimate strategic defense nor a hope for progress in arms control eliminates our need to maintain this deterrent until it can be replaced with something better.

I think the first message is—deterrence is what we know how to do.

We have been successful. We must not undermine this capability until we have replaced it with something better, either a strategic defense, some future of improved conventional warfare, or some negotiated reduction in nuclear weapons between the United States and the Soviet Union.

So, the Department of Energy budget is, indeed, an integral component of our ability to maintain a credible nuclear deterrent.

The second point has to do with fiscal responsibility and cost discipline.

In 1985, the President's Blue Ribbon Task Group, with members chosen by both the executive branch and the legislative branches, was chartered to examine the procedures used by the Department of Defense and the Department of Energy in establishing requirements and providing resources for the research, development, testing, production, surveillance and retirement of nuclear weapons.

This group was asked to recommend changes that might be necessary to improve the managerial and budgetary aspects of this program.

The committee duly reported, and in last year's authorization bill, this committee was responsible for legislation which helped the implementation of some of the recommendations of this Blue Ribbon Task Group, particularly the establishment of the Nuclear Weapons Council, for which I am the staff director and Executive Secretary. Admiral Foley is a Department of Energy representative to this body, which was established by law.

The other two members are Dick Godwin, the Under Secretary of Defense for Acquisition, and General Herres, the Vice Chairman of the Joint Chiefs of Staff.

This group of three has met to consider its responsibilities, and one of its first major acts was to provide this committee with the report requested by Congress as part of this 1987 legislation.

That response details how the Nuclear Weapons Council believes the recommendations of the Blue Ribbon Task Force should be implemented. I look forward to responding to any questions you may have about that report after you have had a chance to look at it in detail.

In addition to the Nuclear Weapons Council, we have created a group called the Nuclear Weapons Council Standing Committee, to handle the more routine issues with which that body must deal. I am the chairman of that group, and that group has representatives from the Joint Chiefs of Staff, the services, and the Department of Energy.

I think the Nuclear Weapons Council will be a very successful group. Let me point out that in the report which was submitted to the Congress, the Nuclear Weapons Council summarizes what it sees as the benefits of having implemented the recommendations of the Blue Ribbon Task Force. It says that the steps which have been taken to implement the recommendations will address chiefly the improved identification of cost versus benefits in the establishment of warhead requirements, higher level involvement in both the Department of Energy and the Department of Defense in the decision-making process, and recognize the need for broader consideration and involvement of the Joint Chiefs of Staff in the weapons development and procurement process.

All these things are underway. The process exists as an orderly one, in which requirements are considered in a step-by-step process before any decision is made to procure a nuclear weapon. One of those important considerations is that we always ask the question—Is there an existing nuclear weapon which will do this job, i.e., do we really need a new design to accomplish the military mission?

The other question that we always ask is—Can we do this mission with conventional capability?

It is not automatic in the system that a nuclear weapon in today's stockpile will be replaced with a modernized nuclear weapon as it becomes technologically obsolete. The system is designed to examine whether that job can be done more efficiently and more effectively with conventional weapons.

Let me turn to the third point on the chart, and that is the need to maintain a vigorous RD&T effort in the traditional programs, while we support DOE's SDI-related activities.

During the last decade, an outgrowth of exploratory research within the Department of Energy laboratories has been the concept of a nuclear directed energy weapon.

This effort has identified a potential threat that needs to be evaluated and that would need to be evaluated even if there were no United States SDI program, since it does constitute technology with which the Soviet Union could threaten the United States.

It is important to maintain this research on a schedule compatible with the SDI program, because when one gets to the point where one wants to make decisions about deployment, production

of SDI components, it is very important that we understand this nuclear driven directed energy technology.

I think it is important to recognize that this kind of push, this kind of effort, has come on top of the traditional burden that we ask the Department of Energy to bear.

We have not reduced the number of weapons that the Department of Energy must maintain. We have not changed our fundamental deterrent posture. In other words, the traditional RD&T burden in support of today's deterrent has not diminished because of the identified need to pursue so-called SDI-related research.

In fact, in recognition of that, this year, when the Department of Defense was made aware of the Department of Energy's final mark from OMB, the Department of Defense made a conscious decision before the budget was submitted to Congress to reallocate $100 million from the Department of Defense side of the line to the Department of Energy side of the line for one reason that involves two aspects.

One, we were concerned that the SDI-related research was not proceeding at a pace compatible with the rest of the SDI program.

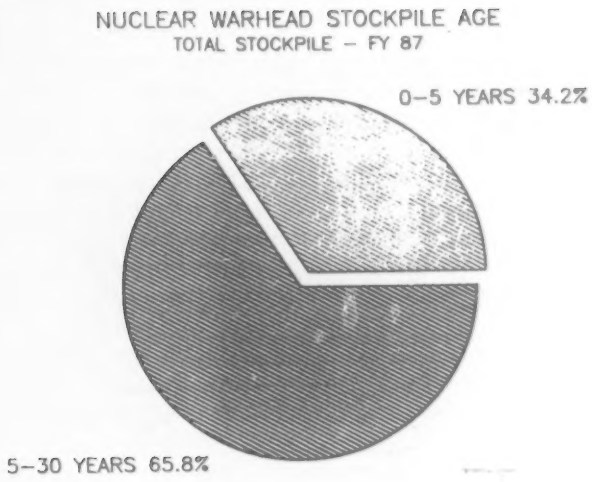
Two, we were simultaneously concerned that in an effort to meet the Department of Defense concerns about that, we did not want the Department of Energy to turn to or be forced to mine the traditional RD&T program in order to be responsive to our needs in the SDI-related area.

So, the Department of Defense and the Department of Energy, in an effort to maintain a sound, traditional RD&T base, as well as an aggressive program in support of SDI, agreed to reallocate this $100 million within the President's budget request.

I make a point of this only to indicate the seriousness with which the Department of Defense views the necessary DOE support in both of these areas of research.

The fourth bullet has to do with modernization of stockpile.

This is an area where I think both the Congress and the executive branch can take pride.



In the last 5 years, we have modernized one-third of this country's nuclear stockpile. Modernization comes about in general because of measures the Soviets have taken which diminish the credibility of our own deterrent.

So we find ourselves replacing systems which we call obsolete. Sometimes they are obsolete in part because of technological change. The other reason why they are obsolete is because the Soviets have made changes in those things which we must hold at risk that make our own systems less effective.

To say it in another way, the Soviets have hardened their targets such that our existing deterrent is no longer as effective.

The other reason our systems become obsolete is because the Soviets take measures which threaten the survivability of our deterrent. They have improved their antisubmarine warfare, thereby threatening in some future time our sea-based deterrent. They have developed better conventional air defenses, thereby threatening the airborne leg of our strategic triad. They have improved the range and accuracy of their tactical systems and thereby have threatened the survivability of our tactical deterrent.

So, it is Soviet measures, by and large, that drive modernization. And we, in fact, have not been as responsive to that changing threat prior to the last 5 years as we should have been. That is one reason why we have actually modernized one-third of this deterrent in the last 5 years, with significant support from the Congress.

It could not have happened without that congressional support.

But let me focus on what we have not done.

We have modernized one-third, but two-thirds remain to be modernized.

The next four charts will show you some of the details of what still needs to be done.

USE CONTROL FEATURES

[Slide deleted.]

The first thing I am going to turn to is use control features, a very important aspect of any weapon which is stored in a place where it is potentially accessible to unauthorized persons. Certainly, the European theater is a prime example of that kind of situation. But, even with a mobile land-based missile based in the United States, the small ICBM, we are exposing a nuclear delivery system to an environment where terrorists may be able to get to it.

One of the things we discovered years ago was complex locking mechanisms which are designed to insure that an unauthorized person cannot derive a nuclear yield from a weapon.

In the old days—you can see the top part of the chart bounded between the red line and the green line—we used simple combination locks. But technology has improved and today's state-of-the-art is a thing that we call Category D and Category F.

What you see is PALS, permissive action links. You will see that in 1987, this state-of-the-art in use control devices is only present in about [deleted] percent of the stockpile. So modern locks, capable of denying even a sophisticated threat and a sophisticated adversary's ability to derive a nuclear yield, are only present on [deleted] percent of today's weapons.

The kinds of weapons that will be exposed to that kind of environment are probably about [deleted] percent of the stockpile. So you can see that [deleted] we will have achieved that goal. We will have put these modern locks on every system that should have them. But it is going to take us [deleted].

Nuclear testing plays an important part in assuring that these locks not only perform their role, but also do not interfere with nuclear performance.

Let me go to the next chart which, to me, could be the most significant of all.

INSENSITIVE HIGH EXPLOSIVES

[Slide deleted.]

About a decade ago, the Department of Energy invented insensitive high explosives. This is an explosive that will not detonate, even in the most violent of accidents.

We had two very real accidents in the late 1960s, one over Palomares, Spain, where a B–52 aircraft had a collision. The bombs dropped from those planes hit the ground, and the high explosive in those nuclear weapons detonated. There was no nuclear yield because the Department of Energy long ago solved that problem, but when the high explosive went off, plutonium was scattered across the landscape.

The U.S. Government went to Spain and bulldozed that material up at significant cost. One can imagine what would have happened if that had occurred over a very populated area. It would have been terrible. In today's environment, it would even be worse. I cannot imagine the pressures that would be established for unilateral disarmament under such a situation.

But subsequently, insensitive high explosives were invented. The Department of Energy now knows how to build weapons where, in

that kind of accident, plutonium would not be dispersed in fine particles over acres and acres of territory.

In 1987, less than [deleted] percent of the weapons in the stockpile have this insensitive high explosive. The reason is that it requires a total new design to incorporate the insensitive high explosive. It requires testing, and we have only been able to incorporate it in the stockpile as part of our ongoing modernization program.

We have a big job to do to insure that insensitive high explosives are in all air-carried weapons, and all ground-transported weapons, including the small ICBM.

We need another [deleted] of testing, design, and development in order to modernize the stockpile, such that every weapon that should have insensitive high explosives has it.

May I have the next chart, please.

NON-VIOLENT DISABLEMENT

[Slide deleted.]

Another issue that a military commander faces day in and day out is that in the event of an anticipated takeover of his nuclear weapons, he must be prepared to destroy those weapons so that no one can get hold of an entire nuclear weapon.

Today, what the commander must do is put a destruct charge on the top of that weapon and detonate it, [deleted].

The Department of Energy has invented devices which can be an integral part of the nuclear weapon and will enable a commander to destroy it in a nonviolent way, such that it cannot give a nuclear yield.

But, again, this requires design and testing in order to incorporate it because these destruct features are buried inside the weapon and thus can have an adverse effect on the performance of the weapon if not done right.

In order to adopt these kinds of features, one must continue to do nuclear testing.

You can see that in 1987, again, about [deleted] percent of the stockpile, only about [deleted] the weapons that should have this feature, has it.

So there is [deleted] ahead of us before this part of the job will be done.

SAFE PREDICTABLE ACCIDENT RESPONSE

[Slide deleted.]

The last issue is safe, predictable accident response.

The Sandia Laboratories, working for the Department of Energy, have invented, if you will, electronic components whose behavior, even in very severe accident environments, can be very accurately predicted.

The electronics that are in today's weapons are as safe as anyone knew how to build them at the time they were built. But a major breakthrough was made about a decade ago in terms of being able to accurately predict the accident response of these electronics in the most violent of accidents.

You can see that in 1987, about [deleted] percent of the stockpile has such features. Again, it will be more than [deleted] before all the weapons in this stockpile will have these features.

The Congress has supported the administration in modernizing one-third of the stockpile. But two-thirds of the job remains to be done, and we look forward to the continued support of the Congress and the continued full support of the Department of Energy budget so that these measures can be taken.

I want to conclude with the same last point that Admiral Foley made. I will not push it any further because I have already mentioned it in conjunction with the last four viewgraphs. Nuclear testing is an integral and essential part of our deterrent posture. Nuclear testing is required to incorporate the safety and security features into nuclear weapons, as well as to modernize our stockpile in response to the changing Soviet threat, which continues on a day-by-day basis to undermine the credibility of our deterrent.

Let me end my remarks right there.

I thank you.

[The prepared statement of Dr. Barker follows:]

PREPARED STATEMENT OF DR. ROBERT B. BARKER, ASSISTANT TO THE SECRETARY OF DEFENSE FOR ATOMIC ENERGY

Mr. Chairman, members of the committee, I am pleased to have this opportunity to present the views of the Department of Defense in support of the Department of Energy's proposed fiscal years 1988 and 1989 nuclear weapons programs. This is my first appearance before you as the Assistant to the Secretary of Defense for Atomic Energy and Staff Director of the Nuclear Weapons Council.

I have accepted my position and the responsibilities associated with it during what I view as a critical period of the United States' nuclear weapons program. The perception of inadequate fiscal accountability and discipline in the Nation's nuclear weapons procurement program led to the formation of the Blue Ribbon Task Group (BRTG) on nuclear weapons program management. This group, chaired by Judge Clark, concluded that by-and-large the system was not "broke." But it did make several recommendations. The Congress, by establishing the Nuclear Weapons Council and eliminating the Military Liaison Committee, has identified that it wants changes. I believe that much of the concern that led to the creation of the Blue Ribbon Task Group was based on "perception" and not "reality." But the DOD joins with the DOE in being concerned that there was even the perception of inadequate accountability. The two Departments share the commitment to work together in ways that will demonstrate that programmatic requirements will continue to be weighed carefully against their fiscal impacts.

America's basic defense strategy, as it has been for the entire postwar period since WW II, is deterrence. In the hands of the United States and in the service of our alliances, nuclear weapons have been a powerful and cost effective force for deterring aggression. Since the beginning of the nuclear era, American strategic thought has stressed the imperatives of deterring nuclear war—dissuading our adversaries by the threat of retaliation from ever using nuclear weapons against the United States, our allies, or our friends. Our defense policy also relies on U.S. nuclear weapons to deter conventional attacks. The cornerstone of our deterrent posture is our nuclear weapons capability. This cornerstone has served our Nation well. For over four decades, the U.S. nuclear umbrella has averted war on a global scale—a challenge which conventional forces failed to accomplish during the first half of this century.

Neither the promise of strategic defense nor the prospects for deep arms reductions obviate the need to maintain a nuclear deterrent and to keep our nuclear deterrent strong and responsive to the changing threat. For the foreseeable future, we must maintain a modern and credible nuclear deterrent—a requirement that mandates not only adequate forces and effective plans for their use, but also effective command, control, communications, and intelligence (C^3I), and reliable, safe warheads.

I believe it is useful to reexamine the mission and broad requirements placed on this country's nuclear weapons program in support of our national security. In the

area of research, development, and testing (RD&T), the requirements are best stated by several of the safeguards which the Senate wisely incorporated as part of ratification of the limited test ban treaty in 1963:

The conduct of comprehensive, aggressive, and continuing underground nuclear test programs designed to add to our knowledge and improve our weapons in all areas of significance to our military posture for the future.

The maintenance of modern nuclear laboratory facilities and programs in theoretical and exploratory nuclear technology which will attract, retain, and ensure the continued application of our human scientific resources to those programs on which continued progress in nuclear technology depends.

In 1979, the joint Department of Defense/Department of Energy (DOD/DOE) long range resource planning group, directed by Lieutenant General (Retired) Alfred D. Starbird, was established to develop and propose guidance for a 20-year nuclear weapon program, including, in part, resource planning for RD&T, production, materials, manpower, and funding. The study was directed to consider the needed fabrication and assembly plant capacities, the nuclear materials production capacities, the need for any other special materials that could be in short supply, as well as the requirements to modernize production plants and testing and research facilities. It was further directed to devise guidance adequate to develop balanced research, development, nuclear testing, nonnuclear testing, weaponization, and production programs for the Nation's nuclear weapons systems, considering needs for all of the crucial elements that are required to maintain confidence in our nuclear deterrent.

While some of the specific Starbird Study recommendations are now outdated, the general thrust is still relevant to determining requirements necessary to maintain a credible long-term nuclear deterrent. In summary, the Starbird Study recommended that a vibrant ongoing nuclear weapons program should be founded on the following:

For the production complex, the major factor in research planning is the preservation of a capability to manufacture nuclear weapons and to maintain the stockpile. This requires the maintenance of specialized plants and facilities capable of handling peak demand for weapon manufacture, and a pool of experienced personnel.

For the special nuclear material component, the principal factors affecting resource planning are (1) the need to replace tritium periodically in order to keep the stockpile operable, and/or (2) the very long leadtimes and relatively high costs associated with obtaining additional plutonium, tritium, and highly enriched uranium.

For the RD&T component, the most vital asset is the pool of trained and experienced scientists and engineers and the specialized facilities they use. There is no industrial or academic counterpart elsewhere in the U.S. for many of these capabilities. People experienced in nuclear weapon design cannot be replaced easily or quickly. Thus, a prime factor in RD&T resource planning is to ensure the stability of this work force by providing sufficient challenge and incentives to retain experienced personnel as well as to recruit new talent.

The DOD believes that these broad requirements identified by the 1979 Starbird Study are still valid, and we seek congressional support to achieve the long-term objectives of the nuclear weapons program and provide funding necessary to maintain stability in supporting those objectives.

The DOE nuclear weapons program is a national asset which contributes to our national defense in ways beyond its primary mission of developing and producing nuclear weapons. The core of experience provides spinoff benefits, otherwise unavailable, to the DOD. A good example is the activity, primarily at Sandia National Laboratory, to develop new technologies to improve the security of nuclear weapons and nuclear material in DOE custody. Because of the capabilities and expertise developed in the DOE program, the DOD has been able to improve its own security posture by requesting DOE to take the initiative in identifying useful improvements. This relationship has produced, for the DOD, intrusion detection systems, weapon access delay systems, weapon storage vaults for bombs, and other improvements. Sandia is currently working with the Defense Nuclear Agency to develop the means to counter Warsaw Pact and terrorist threats to the DOD nuclear stockpile in the 21st century.

This is just one example of the value of a strong DOE RD&T core program, whose experience and level of competence provide assistance to other agencies.

During the last decade, an outgrowth of exploratory research has been nuclear-driven directed energy weapons (NDEW). The DOE nuclear-driven directed energy weapon activity is crucial in order to determine the feasibility and effectiveness of such systems when used against future U.S. Surveillance and defensive systems, as well as against our present deterrent forces. This effort to evaluate a potential

threat would be needed even without a U.S. SDI Program. However, maintaining the DOE SDI-related activity on a schedule consistent with SDI milestones is a significant expansion of DOE's traditional and ongoing RD&T responsibilities.

It is therefore essential to maintain the traditional RD&T program in support of our deterrent posture while providing the additional funding requested by DOE to support DOE's SDI-related activity. In order to maintain stability in the traditional program, while providing for a DOE SDI-related activity consistent with DOD milestones, the two departments—DOD and DOE—again reached agreement on the need to augment, prior to submitting the President's budget to the Congress, the DOE fiscal year 1988 request, as was done in the fiscal year 1987 request, at the expense of decrementing the President's DOD budget. The budget request before you reflects such augmentation. I urge the Congress to consider during its deliberations the commitment that this augmentation represents by the DOD to both missions—traditional RD&T and SDI-related research.

I would now like to address the recommendations of the President's Blue Ribbon Task Group [BRTG]. The group was chartered to examine the procedures used by DOD and DOE in establishing requirements, and providing resources for, the research, development, testing, production, surveillance, and retirement of nuclear weapons and to recommend any needed change in coordination, budgeting, or management procedures. Some of the recommendations were put in place by the National Defense Authorization Act for Fiscal Year 1987, section 3137, "implementation of the recommendations of the President's Blue Ribbon Task Group on nuclear weapons program management," which established a joint Nuclear Weapons Council (NWC). The NWC will submit a report to Congress shortly on the actions that have been taken by the two departments to implement the BRTG recommendations. I will not address each of the recommendations now. I support the overall thrust of the BRTG recommendations. I also support strongly the task group caution that "adopting more drastic measures to improve cost consciousness and accountability could upset the delicate balance between competing concerns. It is important that cost control procedures not cut corners in critical areas such as nuclear safety or inhibit the innovative and aggressive technology base activities."

With regard to the nuclear weapons development process and the resulting production requirements, I believe we have established an orderly system which assures that the development processes of the two departments are synchronized. This system is based on interdepartmental agreements, which are implemented within DOD by directives and instructions. It is DOD policy that nuclear weapon concept definition and feasibility studies and development engineering projects shall consider total weapon system cost and performance in establishing military requirements and design objectives. Further, phase 2 joint feasibility studies are required to address the use of existing assets by responding to the following questions:

What nuclear devices in production or under development appear to meet the requirements?

What are the advantages and disadvantages of each?

Both Departments are well aware of the limited resources of the nuclear weapons program and the need for careful consideration of the allocation of these resources. The system should be free to study and determine the most cost effective options for future systems. We have an obligation to examine all possibilities in order to assure the best use of our limited resources. I pledge to you that any decision to produce and deploy new systems will receive careful review within the executive branch, I am confident the same will be true in the legislative branch.

As a part of my testimony, I plan to annually update you on the state of the stockpile.

The stockpile has declined from approximately [deleted] warheads in 1967 to [deleted] the current stockpile of [deleted] warheads. In the current plan, about [deleted] warheads will be built [deleted] during fiscal year 1987-1992.

[Deleted] the modernization of the strategic offensive forces, principally the Peacekeeper, Trident II and cruise missile programs, [deleted]. Negotiations could permit retirement of these older warheads.

Although modernization is continuing for the nonstrategic forces, retirement of older warheads [deleted]. Stockpile warheads planned for retention will be reviewed annually by the Department of Defense and the Department of Energy to ensure their continued safety, security, and reliability.

During this administration one-third of the stockpile has been modernized with respect to use control and modern nuclear safety design criteria: insensitive high explosive (IHE), non-violent disablement, safe predictable accident response, and modern use control features.

On 31 December 1986, the U.S. nuclear warhead inventory consisted of [deleted] 27 different warhead types. The yield of this total stockpile is [deleted]. The nuclear warhead inventory [deleted] during the preceding year. The largest warhead in the inventory, of which there are [deleted]. The smallest yield weapon in the inventory, of which we have [deleted]. The oldest warhead type is the W31Y1, Nike Hercules, of which [deleted] exist with an average age of 27.91 years. The average warhead age on 31 December 1986 was 12.79 years; 1 year earlier the average age was 12.71 years.

Nuclear weapon modernization has occurred primarily when an existing weapon system became viewed as no longer posing a credible deterrent in the face of Soviet measures which have adversely affected weapon effectiveness. Such Soviet measures include steps which threaten delivery system survivability and penetrability of defenses and/or steps which reduce weapon effectiveness, such as hardening or mobility of intended targets. The replacement weapon system generally requires a new warhead to be compatible with the environments which the new weapon system will impose on the warhead. The new weapon may have a smaller or larger yield than the weapon it replaces, depending, for example, on whether higher accuracies justify a lower yield or whether increases in target hardness require higher yields even with increased accuracy. Whenever a new weapon is designed, it incorporates the state-of-the-art in nuclear weapon safety and security features.

The nuclear weapon modernization process is, therefore, not such that the oldest weapon is the next to be modernized. Within the limited resources available for nuclear weapon systems modernization, priority in modernization goes to the system whose reduced effectiveness as a deterrent is viewed as being most important politically and militarily. As a result, some weapons have become so old that their safety and security features, while adequate to meet nuclear safety standards, do not meet modern nuclear safety design criteria. This has led to stockpile improvement program (SIP) upgrades of particular weapon features of some weapons to redress these deficiencies.

Stockpile Improvement Program.—The joint DOD/DOE Stockpile Improvement Program (SIP) was initiated formally by the Military Liaison Committee in 1979, with the goal of identifying the nuclear weapons in the stockpile that needed to be modernized, those that needed to be retired or replaced, and those which required no action. Each year a review is accomplished with the objective of examining each deployed weapon, its operating environment, service recommendations, results of studies, present SIP efforts, and/or planned retirement/replacement programs.

The major emphasis in 1986 concerned the tactical bomb stockpile initiative (TBSI); the W69, SRAM A; and the W50, Pershing I. In the TBSI, [deleted] B61 warheads will be upgraded [deleted]. Completion of the W69 retirement will be [deleted] reflecting a replacement by the SRAM II, which incorporates a modern warhead with modern safety and security features. For the Pershing I, options [deleted] are being considered, with the study scheduled for completion in June 1987.

In those cases where our requirements can best be met by the development of new systems and warheads, the following systems are under development, in production, or have been deployed.

ARMY

W79 (8-inch) and W82 (155MM) Artillery Fired Atomic Projectiles (AFAP).—The W79, modernized 8-inch AFAP, completed production in fiscal year 1985. This new weapon provides reduced reaction time and increased range [deleted] increased reliability, and modern safety and security. [deleted].

In accordance with the provisions of the fiscal year 1985 DOD Authorization Act, the production program for the modernized [deleted] W82 155MM AFAP has begun. The W82 has entered the production engineering phase and fielding is planned for [deleted]. This program is a necessary first step toward achievement of SACEUR's long-term objective of [deleted] fulfilling part of the modernization requirement associated with the 1983 NATO decision at Montebello to reduce the European stockpile. The current W82 program will provide replacements for [deleted] of the approximately [deleted] aging 23-year-old W48s and will include modern safety, security, and control devices along with providing increased reliability, range, and accuracy. The 925 modernized projectiles authorized by the fiscal year 1985 DOD Authorization Act will not meet NATO or worldwide CINC requirements. Therefore, older weapon systems (W33 and W48) will be retained.

Pershing II deployment.—All 108 Pershing II have been deployed to U.S. forces in the Federal Republic of Germany in accordance with NATO's 1979 dual-track decision. Production of the W85 warhead for this system has been completed.

Follow-on to Lance.—SACEUR has stated [deleted] follow-on to the Lance Missile system with increased range and accuracy, [deleted] and improved operating characteristics. [deleted] have stated similar requirements for a replacement for the current Lance. [Deleted] in order to meet the needs stated by these [deleted], studies are necessary for making a decision (based on operational effectiveness, feasibility, and cost), on the best system to replace the Lance. The Army has begun studying candidates for the follow-on to Lance and plans to initiate a formal phase 2 nuclear warhead feasibility study with the Department of Energy this year. We expect to fully justify to Congress any request for a Lance follow-on system.

NAVY

TLAM/N. The Tomahawk nuclear land attack cruise missile, or TLAM/N, greatly enhances the Navy's deterrent posture by distributing Navy retaliatory striking power across a large number of naval platforms. This increases the number of Warsaw Pact targets that are put at risk and greatly complicates Soviet defensive efforts. Tomahawk complements the power of the carrier air wing and multiplies the effectiveness of the force at sea. TLAM/N will also contribute to the NCA's ability to deter strategic conflict and will provide additional survivable assets for the nuclear reserve force. TLAM/N reached initial operational capability (IOC) in June, 1984, and will be installed on the following classes of ships: SSN–637 Sturgeon and SSN–688 Los Angeles class attack submarines: DD–963 Spruance and DDG–51 Arleigh Burke class destroyers; CGN–9 Long Beach, CGN–38 Virginia, and CG–47 Ticonderoga class cruisers; and BB–61 Iowa class battleships. At present over thirty Navy ships and submarines are certified to carry TLAM/N. Within the next five years, [deleted] TLAM/N will be deployed in [deleted] ships and submarines.

Sea Lance. A nuclear variant of the Sea Lance submarine-launched ASW stand-off weapon is required to replace SUBROC, a 23-year-old system which is incompatible with our modern fire control systems.

A DOD-directed special study of the Sea Lance (nuclear) in the summer of 1986 reaffirmed the need for this weapon. To ensure a long-range high probability of kill against the modern Soviet submarines, the Navy is currently validating yield and inventory requirements for the nuclear variant. [Deleted].

Nuclear Depth/Strike Bomb. A new air-delivered nuclear depth bomb with strike capability is needed for our ASW aircraft force. The Navy and the DOE are in the final stages of a phase 2A study to examine warhead candidates, including a variant of an existing B61. This nuclear depth/strike bomb, with modern safety and security features, is planned to replace the 28-year-old B57 tactical strike bombs and B57 depth bombs which will be retired [deleted]. This commonality will allow smaller aircraft carrier bomb loadouts than would otherwise be possible with separate tactical strike and depth bombs, thereby reducing overall stockpile numbers of fleet strike and depth bombs. The nuclear depth/strike bomb has an IOC [deleted].

Trident II (D–5) W88. The Trident II (D–5) missile is now in its fourth year of full-scale engineering development, and completed its first flight test in January 1987. DOE is developing the W88 [deleted] warhead for this missile. [Deleted] the D–5 will provide our survivable, sea-based strategic force with greatly improved hard target kill deterrent capability. D–5 will first become operational when it goes to sea in the ninth Trident submarine from its home base at Kings Bay, Georgia. The ninth and subsequent new construction Trident SSBNs will be D–5 equipped.

The original eight Tridents will be backfitted with the D–5 systems during regularly scheduled overhauls. The submarine base at Bangor, Washington, will be equipped to support D–5 by 1994 as we proceed toward an all D–5 Trident force.

AIR FORCE

In the area of intercontinental ballistic missiles, the 19 December 1986 Presidential decision stated that we should "proceed with full-scale development of the small ICBM and begin development of a mobile rail garrison basing mode for Peacekeeper." In addition, the President stated the "initial operating capability for the small ICBM would be achieved in 1992." Before any funds from the Department of Energy's budget can be spent on warheads for the 2nd fifty Peacekeepers, congressional restrictions imposed in fiscal year 1985 must be lifted.

The small ICBM is currently undergoing a phase 2A study which identified the baseline warhead design as a modified version of the Peacekeeper warhead, the W87. The SICBM warhead, as appropriate for a mobile system, will incorporate necessary use control features.

We are continuing our concept studies to ensure our ability to satisfy changing defense needs. The Air Force, in conjunction with the DOE, performed studies to

identify nuclear weapon concepts to hold hardened/underground and deeply buried targets at risk by our strategic forces. These studies identified earth penetrating weapons coupled with high accuracy delivery systems (aircraft and ICBM) as being effective against these targets. Additional studies will be performed to identify the operational tradeoffs, costs, and design specifications of earth penetrating weapon systems.

The B53 bomb, which was in the inactive reserve, is being returned to operational status [deleted].

I would like to close by briefly addressing nuclear testing. In the past few years the need for nuclear testing has received much attention. We have provided the Congress with reams of information and hours of testimony as to the essential nature of nuclear weapon testing and its place in our national security posture. I will not repeat or even summarize that prior dicta. However—fearing that the heart of the issue may have been obfuscated by the fusillade of words—let me restate the obvious. As long as we must continue to rely on nuclear weapons to secure this Nation and maintain the peace, attempts to ban nuclear testing are more than foolish—they are dangerous in the extreme. In addition to the need for nuclear testing during the development and certification of our nuclear weapons and verification of reliability, the broader contribution of underground nuclear effects test to our deterrent posture is critical.

Underground nuclear weapons effects tests are of direct national importance in that they directly support the development and certification of the nuclear hardness of critical weapon systems, including tactical weapon systems; command, control, communications and intelligence systems, as well as strategic nuclear systems such as the Peacekeeper and Trident II. These tests are highly complex, and often several tests are needed in conjunction with extensive above ground tests to validate a given system for operational use over the total nuclear environment. The effectiveness and credibility of these systems hinge directly on the success of these development and certification tests. The DOD and DOE laboratories derive invaluable fundamental nuclear effects research data for use in the development of the technology base. The development of missile basing systems, including the Air Force Peacekeeper and small missile programs, are supported by tests which are defined and conducted to provide nuclear blast and shock environment not suitable to investigation by simulation or calculation. Recent underground test program emphasis has been on vulnerability and hardness of the Peacekeeper missile and MK-21 reentry system, the Trident II D-5 missile and MK-5 reentry system, and their components and subsystems. Tests conducted in direct support of the Trident II and small ICBM engineering development milestones will receive special emphasis in the future events. Underground tests are also being used to support the Strategic Defense Initiative program in conducting X-ray laser lethality and survivability experiments and experiments associated with the Army's ERIS and HEDI ballistic missile defense systems.

In summary, let me make the following points:

The cornerstone of our deterrent posture is, and will be for the foreseeable future, our nuclear weapons capability.

We must maintain a vigorous RD&T effort in the traditional program, while supporting DOE SDI-related activities consistent with DOD milestones.

Fiscal responsibility and cost discipline must be fundamental to the nuclear warhead procurement process.

Modernization of the stockpile, including modern safety and security, is only one-third complete and must be continued.

An orderly system for the nuclear weapons development process presently exists, and should be allowed to function as intended.

Nuclear testing is an integral and essential part of our deterrent posture.

This concludes my formal testimony. I would be happy to answer questions.

Senator EXON. Dr. Barker, thank you very much. We will now go to questions.

Let me start out by asking a very general question, but I think a very important one.

Essentially, you brought out something this morning that we knew was there, but with the drive for new systems and with the concern over the budget, we put something like this off because nobody wants to build a dump until you have to build a dump to get rid of the garbage.

I think we have a critical situation on our hands here.

Let me ask you this question.

BUILDING WASTE DUMP

What is the view of each of our witnesses with regard to the general magnitude of the costs involved to meet the environmental, health, and safety standards that you have outlined in your presentations this morning?

To put it another way, how much more per year in dollars would we have to add, beginning with this year's budget, to begin to make meaningful progress, which you clearly indicated this morning is not currently being accomplished?

Admiral FOLEY. Let me address that first, sir.

I would say that we have not been able to aggregate all that amount yet because we are still in the process of characterization and prioritization across the country under the aegis of our Assistant Secretary for Environment, Safety, and Health, Mary Walker, who is leading the charge in this direction.

The Department is committed to getting on with that.

At the present time, we have a cross-cut through all of our programs of about $700-plus million in environment, safety, and health. This, as I say, is going up about 10 percent a year. It has gone up 31 percent between fiscal year 1985 and fiscal year 1988, so, clearly, we are increasing the amount of money in it.

In aggregate, in my judgment, it will be in the billions of dollars. I cannot give you a finite amount yet. We will get back to you, sir, with the best judgment that we can come up with at this time.

Senator EXON. It would be helpful if we had that before markup, Admiral, because this is one of the things that we are going to be dealing with very shortly.

[The information follows:]

ENVIRONMENTAL, SAFETY, AND HEALTH EXPENDITURES

As stated earlier, DOE is still in the assessment and planning process to determine what are the ES&H vulnerabilities and the needed corrective actions, including priority, estimated cost and schedule. This is an on-going process with results expected over the next several years. The Environmental Surveys and Technical Safety Appraisals will contribute to our assessement and planning efforts to assure they are comprehensive.

DOE is also in the process of identifying the areas of potential contamination resulting from past waste management practices to determine the needed remedial actions. For FY 1988, about $60 million is required to continue mainly the on-going preliminary assessment activities. We expect most of the assessment activities to be completed by 1990 with remedial actions starting at that time. The DOE assessment activities and selection of the remedial actions will be performed in accordance with the applicable laws and regulations with the involvement of the Environmental Protection Agency and state regulatory agencies. Cost estimates and schedule for the remedial actions will be determined as we complete these assessment activities.

Senator EXON. Can you give me any ballpark figure for what you might estimate it would be for the next fiscal year budget that we are working on?

Admiral FOLEY. We have requested in cross-cuts $740 million in the budget, sir. So, we say quite candidly, that is——

Senator EXON. That is from what to what?

Admiral FOLEY. For fiscal year 1988.

Senator EXON. I mean the amount of increase over last year's.

Admiral FOLEY. The percentage between fiscal year 1985 and fiscal year 1988 is a 31 percent increase.

Senator EXON. Yes.

Admiral FOLEY. Between last year and this year in the cross-cut, it goes from $650 million to about $740 million. So we have added another $90 million or so on to that, coming out of our overall programs.

Senator EXON. Are you saying, then, that if we would add another $90 million, we would be into that area of beginning to meet the need? Is that what you are saying?

Admiral FOLEY. No, sir. I am saying that we are into that area now. We are meeting the needs. We are meeting the regulatory requirements.

But in order to go back and clean up the 40 years' worth that we have, it is going to take a lot more money than that.

There is a ballpark number that I do not have now. I will get back to you with our best estimate.

Senator EXON. That would be fine.

Do you have anything to add to that, Dr. Barker?

Dr. BARKER. No, Senator Exon. I do think we have to recognize that this is a national issue. The Atomic Energy Commission, ERDA, and now the Department of Energy for defense programs has carried the mission for this country, which has enabled us to maintain a nuclear deterrent since the nuclear age. Attitudes have changed, our knowledge has changed, and we recognize the need today, as you say, to establish a dump to get rid of the waste that has been created over the years.

But I would hope that we can find a way to solve this problem without asking our ability to maintain a continuing and credible deterrent to pay for the entirety of this endeavor. It really is a national burden that has been taken on by the Department of Energy over many, many decades. We cannot expect the deterrent over the next decade to pay for the sins of the past three or four decades.

Senator EXON. Since, obviously, the mop-up is going to be as much as the cost of the program, as the Admiral said in response to a question has there ever been any consideration given to having a fixed percentage of these items, when we produce them, that should be set aside for eventual cleanup?

Admiral FOLEY. There have been such proposals, yes, sir. I know they have existed in the past.

One of the dangers is that when you are trying to balance the overall budget and the production complex against the cleanup, perhaps 10 percent for environment, safety, and health will stay absolutely inviolate and your reductions then will take place on the other side, resulting in an unbalanced program.

So, instead of putting an absolute percentage, an absolute fence, around a particular number, I would rather come in and justify the amounts that are going to be done within a range of percentage. In other words, I'd come in with a carefully structured program to you instead of going overboard on one side.

Senator EXON. But when you come in with a program, Admiral if you said this is going to cost a billion dollars for this particular system, is it going to cost also an additional billion in future years to clean up? We will have to face up to this thing.

Cleaning is a tremendous cost, and I do not think it ever has been recognized, and it should at least be addressed when we begin.

Do you agree?

Admiral FOLEY. I agree completely.

Let me point out two things that are ongoing.

The first one is the Department is committed to this action. That is why the Secretary, John Herrington, appointed a new Assistant Secretary to get on with this particular issue. So the characterization and the prioritization of all of this cleanup is now ongoing.

My frustration and inability to give you an answer is because it is not over yet. It is going to take a couple of years to do this.

So we are in the process of doing just exactly what you are asking for.

The other one is in the budget process. We are looking at how to come up with a line item that talks just about the cleanup—the environmental issues that come up. How do we go across the entire program and take those funding issues and lay them all out as one finite number to give it more visibility, so that you have a better feel for it as an individual line item?

We are working on that issue right now with all of our field managers.

MX MISSILES

Senator EXON. Gentlemen, what kind of problem do we have with future production of MX warheads?

Should the Congress approve the rail garrison MX program and deployment timetable that has been presented to us? Will this require specific legislative relief this year?

Admiral FOLEY. We can meet the existing requirement, as given to us. If the requirement has changed from more than 50 weapons, the answer is yes, sir, we will have to come back and work it out to change the program.

Senator EXON. Do you have anything to add to that, Dr. Barker.

Do you agree with that?

Dr. BARKER. I certainly agree with that. I think the committee fully remembers that the Department of Energy is forbidden from spending any money whatsoever that would provide warheads for missiles beyond 50. So, should any decision be made to go beyond those first 50 missiles, relief will have to be provided in order to allow DOE to build the warheads for those missiles.

Senator EXON. If what we are talking about, gentlemen, is the lead-time, if we are going to start deploying these in 1991, we should be working on this now. This kind of harkens back to the previous question that I asked.

We are thrown into the position here as an authorizing committee of maybe pro and con on going ahead, and we say well, this will be the cost of the program.

I guess, from what the earlier testimony was, that maybe cleanup is about half the total cost of the program.

So, I think we can do a better job of putting things into perspective.

INF WEAPON RETIREMENTS

I have one more question for this round and then I will yield to my colleague.

If we should come to some kind of agreement at Geneva limiting INF warheads to, say, 100 warheads or something of that nature, do you have an early plan for the retirement of such INF warheads; or, if we would come to such an agreement, would that just further over-burden the facilities that you now have?

Dr. BARKER. Senator, the Department of Defense does return to the Department of Energy those weapons which no longer play a role as far as the U.S. deterrent is concerned.

There are many steps to be taken before we know what will happen to the warheads that are currently aboard the Ground-Launched Cruise Missile and aboard the Pershing II. The options that are under consideration range from retiring those systems, which would result in the destruction of the warheads and recycling of the nuclear material, to converting those systems to shorter range systems of less than INF range, which would mean that those systems would not be retired.

As I recall, the Pershing I missile, which had been in existence for a long period of time, had a range on the order of 400 miles, and it has been replaced by the Pershing II. If the Pershing II were totally destroyed, we would, in effect, by a two-step process, have totally unilaterally eliminated one component of our shorter range delivery system. So it is not out of the ordinary for shorter range missiles to be built which might very well use the same warheads that are currently on longer range systems.

Admiral FOLEY. Sir, may I address that in a little different fashion?

Senator EXON. Yes.

Admiral FOLEY. I will set aside the arms control philosophy, or a portion of it, and just address it as a kind of manufacturing problem. In the arms control area, one might just say "promises, promises, we have heard that before."

But whatever determination is made, it is then a question of sitting down with the Department of Defense and our facilities and saying can we defer the scheduled turn-in of some other weapons and take these as a matter of priority, so we adjust the input of the logistics coming in and of particular systems to meet what our capabilities are. The answer is yes, we can handle them. It is like a lot of different contingencies. Exactly what comes in, when it comes in, when you want it—we will adjust to that. We can do that.

Senator EXON. Senator Nunn.

SAVANNAH RIVER REACTOR SAFETY

Chairman NUNN. Thank you, Mr. Chairman.

I know you have already had considerable discussion, and I have had to be in other meetings. I wish I could have been here for all of it, and I will catch up on what I missed.

Being from Georgia and concerned about the Savannah River Plant, I want to ask just one question and then I will review the record because I know you have gone over this. I will also have

probably four or five questions for the record after I see what has been said.

Are you both satisfied that that plant is, indeed, being operated safely today?

Admiral FOLEY. Yes, sir—to the best of our knowledge. We are doing studies at Los Alamos and with the National Academy of Sciences' participation to come up with all of the number crunching, to come up with the exact reading which says what will be the impact if this and that happens.

We are going through all of the hypothetical and credible as well as incredible accident scenarios and what particular power range will give us assurance that there will not be damage to the core, for example, if, in fact, we have this particular type of accident.

We believe, and the National Academy of Sciences shares this belief, that the 50 percent level we are operating at now is a safe level.

Chairman NUNN. That is now down to 50 percent from what? What was the level?

Admiral FOLEY. It was about 72 to 75 percent—in that range, when we came down earlier, sir.

We are confident at this stage of the game that we will be able to go back up again once we get through all of the various different supporting hypotheses. But it is going to take us a little while to do that.

So, in the meantime, we are operating at 50 percent.

N REACTOR SAFETY

Chairman NUNN. Is the same thing true at Hanford?

Admiral FOLEY. It is a different situation at Hanford, sir.

We are in a stand-down mode at Hanford for a 6-month period while we put in some safety enhancements. We want to widen the margin of safety. There is a scenario at Savannah River that says we must throttle back to widen the margin of safety. These enhancements are being put in at N Reactor, again to widen the margin of safety for both credible and incredible accidents. In the determination of all the experts that we have had look at it, it would be safe to start back up again around the July timeframe, while we continue on with at least a partial environmental impact appraisal.

Chairman NUNN. Secretary Barker, are you familiar with this? If so, do you agree?

Dr. BARKER. I am not familiar with the details, Senator Nunn. The Department of Energy has been very, very prompt in keeping the Department of Defense informed of all matters with respect to these reactors. We have confidence in the way the Department of Energy is proceeding.

NUCLEAR WEAPONS COUNCIL

Chairman NUNN. Thank you.

Let me ask a question on another subject.

In your judgment, how well has the Nuclear Weapons Council performed since it was established? Do you recommend any changes legislatively?

Admiral FOLEY. We had our first meeting on February 13, 1987. The three principal members, in fact, the three members were all in attendance: Under Secretary Godwin, General Herres, and I. Dr. Barker is the head of the supporting staff, and Secretary to the Council itself. He sits in with his cogent advice and the support of the supporting staff.

I think so far it is promising. I will make the statement that I was very encouraged at the first meeting because, quite clearly, I see a venue in which decisions can be made, and it does not have to go on up to the Secretary of Defense or Secretary of Energy to be done.

I can see the opportunity for prioritization taking place that just was not feasible before, with all the services participating.

General Herres represents the services, the Under Secretary represents the Department of Defense, and he can prioritize and make the decisions.

To me, it looks good.

Chairman NUNN. No legislative recommendations?

Admiral FOLEY. Not at this time, sir.

Chairman NUNN. Dr. Barker.

Dr. BARKER. As someone who has watched the three members, as legislated by law, operate, I think you would be very pleased, Senator Nunn. All three gentlemen, including Bob Foley, pitched in and established a mechanism for working together and established a mechanism by which the more routine matters can be handled by establishing a Nuclear Weapons Council Standing Committee, which they have asked me to chair, to handle the more routine matters. They have already voted on significant issues in this first meeting, amongst which were some issues that are represented in the report which has just been given to the committee.

They have handled other matters by mail vote.

The report given to you does suggest two changes in the legislation. The 1987 legislation indicated that the Director of Defense Research and Engineering should chair the Nuclear Weapons Council. Dick Godwin, as the Under Secretary of Defense for Acquisition, has actually filled that position in the absence of a DDR&E. The Nuclear Weapons Council has recommended making the Under Secretary of Defense for Acquisition the chairman, by law, to correct that oversight.

The other issue is with respect to my own position, which is an issue we discussed a year ago, about maintaining a Presidential appointment.

So those are the two recommendations that were made in the Nuclear Weapons Council report.

Admiral FOLEY. Let me qualify my response, if I may, sir, by stating that I strongly support the inclusion of Dr. Barker in his position, and the other is an administrative change that I think could be made.

But, quite substantively, one of the things in there that I like is there were proposals that others be included in this Council. The three of us at this stage of the game do not believe we need anybody else right now. We think that we are qualified and capable of handling the decisions that would come up.

Now, later on, if we change our opinions, we can come back to you. But, at the moment, I think it looks pretty good, and we can keep the outsiders out and focus on the issues.

NUCLEAR WEAPONS COMMAND AND CONTROL

Chairman NUNN. Thank you.

Shifting to another subject, Admiral, can you explain the rationale of why U.S. nuclear weapons aboard our surface ships are not equipped with permissive action links, or PAL devices?

It is my understanding that we have those devices on bombers and the tactical aircraft. How do we distinguish between the need for them there and the lack thereof on the surface ships?

Admiral FOLEY. I would defer that question, sir, to Dr. Barker.

Chairman NUNN. Dr. Barker.

Dr. BARKER. The issue of using PALS on surface ships as well as on other deployed systems is still under review, Senator Nunn. I do not view it as a settled issue. The issue of nuclear weapons command and control is something which we take very, very seriously.

To date, the Navy has convinced successive Secretaries of Defense that the administrative procedures aboard ship are such that they provide the same level of security that is provided by the mechanical features that have been incorporated into land-based designs. But this is not an issue that was addressed and put aside. It is an issue which is currently being reexamined, and I cannot predict at this time how it will come out.

Chairman NUNN. At what level is that being reviewed, and when do you think you will have a decision?

Dr. BARKER. Let me just say that the Chiefs are involved and the Navy, going up to the Secretary of the Navy level, is certainly involved in this issue, along with the Chief of Naval Operations.

We have not established a formal timetable for the completion of this work. It is more of an ongoing dialogue.

Let me check with my staff to see if we have a date?

[Pause.]

No.

Chairman NUNN. Could you keep us informed on that? I am very interested in this matter.

Dr. BARKER. I would be happy to do that.

NUCLEAR SAFETY

Chairman NUNN. From what I understand, the Chernobyl incident in the Soviet Union has basically had an almost traumatic effect on the Soviet Union in terms of their taking a look at their own safety. That may or may not be right.

But I believe that with the degree of dependence we have on nuclear weapons—which I would like gradually to move away from, but I think we are going to be in it for quite a while—one incident would shatter the confidence of the American people in the safety of our nuclear weapons, whether at sea or anywhere else. It could even stop short of an actual catastrophe. It could just be an incident that would point out the dangers, and it would have profound effects in this age on our ability to maintain our deterrence.

So I cannot emphasize that strongly enough. You experts will have to weigh that, but I really think this is important.

Dr. BARKER. I agree with you totally, Senator Nunn. It is important for you and your colleagues to appreciate how critical the role of nuclear testing is in being able to incorporate the safety and security features that we now know how to build into tomorrow's stockpile.

Chairman NUNN. I would like for you to keep us informed on that.

Senator Thurmond, they have both answered questions on the Savannah Plant issue, on which you and I have mutual interests. It is operating at a lower level, which they believe is safe, but they are continuing to monitor and review that and have a lot of activities.

I will have some questions for the record on this. I know that you have been very much involved in that, too, and we are both interested in it.

Thank you, Mr. Chairman.

Senator EXON. Thank you very much, Senator Nunn.

Gentlemen, I have to leave now for a previous appointment. I will turn this over to my colleagues.

I want just to thank you for an excellent presentation. We may have a very few questions for the record, and I hope you will get back to us before the markup if we do have any. This is a very important matter that we are talking about this morning, and I thank you.

I want to say to my colleagues from Georgia and South Carolina that we, in Nebraska, look with covetous eyes on some of their defense facilities, but, as far as Savannah River is concerned, we think it is located in exactly the right place.

We are not going to challenge you on that. I think I will yield now to my colleague, the ranking member of this subcommittee, Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman. I am happy to hear that you are in favor of the Savannah River Plant——

Senator EXON. By the way, we will keep the record open until tomorrow.

Senator THURMOND. We appreciate your cooperation.

Chairman NUNN. Oh, he is all heart.

SAVANNAH RIVER REACTOR SAFETY

Senator THURMOND [presiding]. Admiral Foley, I have talked to you previously about the safety situation down there and the fact that the power has been cut in half. Senator Nunn is concerned, too, about this. We all are, of course. It is not only the safety of our people, but I think it could be very detrimental to our national defense if anything should happen at any of these installations because it might turn public opinion the other way, which would cause a great handicap in going forward with weapons that we ought to go forward with.

Admiral FOLEY. I agree with everything you say, Senator.

I would like to make a point for the record, because the flavor of your questioning tends a little bit toward the fact that the Department of Energy would knowingly run a reactor or a plant that was unsafe. That is not the case in any way at all.

Safety dominates our considerations, and we would never run a production plant just for the sake of producing if we thought it was unsafe.

Senator THURMOND. I am sure that is correct. I did not mean to give that inference at all. But sometimes something might happen that you might be unaware of. I am sure you would not do anything like that knowingly.

We are just interested in protecting our people and at the same time doing nothing that would deter our defense. We ought to go forward with that.

NUCLEAR TESTING

Admiral Foley, your chart on Soviet-United States nuclear testing would be very useful in our upcoming debates on testing limitations. Can that chart be made unclassified? That would help us a lot in the debate, if we could use that chart.

Admiral FOLEY. I would have to take that one for the record, sir, and go back and run it through our sources to find out if it can be made unclassified.

Senator THURMOND. I wish you would. There really is no reason it should be classified, as I see it. At any rate, we hope you can do that. That will help us to help you, of course.

Admiral FOLEY. Yes, sir.

[The information follows:]

The Department of Energy conducted a classification review on the chart depicting Soviet nuclear testing and determined that it could not be made unclassified.

Dr. BARKER. Senator Thurmond, if I may, I suspect that Admiral Foley will not be very successful in getting that chart declassified for the following reason. It indicates the number of Soviet tests that we have detected. We are quite confident that we have not identified the totality of Soviet tests. By publishing that number, the Soviets will know exactly how many tests they have gotten away with, which might, in fact, encourage them to conduct tests in a way which could not be detected.

Senator THURMOND. Well, perhaps it could be worded in such a way to say that this does not include all of the Soviets tests, but it includes enough to give an indication of what is going on—something like that. Perhaps it could be worded in such a way.

Dr. BARKER. We will work together with that objective in mind.

NEW PRODUCTION REACTOR

Senator THURMOND. Thank you very much.

Admiral Foley, what options does the Department have for early and cost-effective replacement of existing production reactors, and how do you assess these options?

Admiral FOLEY. The options we have identified so far, sir, are really two-fold. The first one is to look at a partially completed reactor on our Hanford Reservation, in Washington, which was originally to be constructed for the Washington Power Supply System.

We have looked at that and, technically, it appears that it could be converted to a tritium production reactor in a timeframe of about 6 years, and a range of cost someplace between about $2 billion and $4 billion. The exact amount would depend on the bond issues and on business arrangements between the Federal Government and the Washington State Authority that would be required for taking it over.

I don't have an exact number, but that would be the nearest and the shortest timeframe replacement. And then, of course, a new production reactor of whatever technology. But I believe, without any question, we need to move along for a new production reactor in the earliest budget cycle that we could get. That would be, to me, sir, 1988.

So I will come back to the Congress early-on, as soon as the Department has made a decision on what technology would be the best to pursue in this regard.

DOE OVERSIGHT

Senator THURMOND. Thank you.

I would like to ask Dr. Barker and you, too, Admiral Foley, this question.

Could you comment on proposed legislation that would provide for oversight of certain aspects of defense nuclear programs by agencies other than DOD and DOE?

Admiral FOLEY. I will address it, first of all, sir, if I may, from the Department of Energy viewpoint.

Dr. BARKER. If I can answer very briefly, I will just say that it is a bad idea. I will let you amplify on it, Bob.

Admiral FOLEY. I will take a different view.

Senator THURMOND. In a way, the Admiral is taking the Department of Energy off the spot in the future.

Admiral FOLEY. I agree with that, sir.

The Department of Energy is looking at it right now. I personally believe it is an idea whose time has come. If some outside oversight, similar to the ACRS, the Advisory Committee for Reactor Safety, which exists right now and works with the Nuclear Regulatory Commission, was created to oversee the Department of Energy's defense programs, I think that that, in my personal judgment, is livable.

But the Department has not made a decision. We are looking at that very carefully now, sir.

Senator THURMOND. Dr. Barker, would you care to express yourself on that same question any further?

Dr. BARKER. I think it is a Department of Energy judgment, Senator Thurmond. I think the Department of Energy and its predecessor organizations have had an admirable history of being able to regulate their own activities. They certainly have the freedom to create whatever advisory bodies they may so choose. So I would have expected the Department of Energy could have handled these issues within the existing structure. But it is, indeed, a Department of Energy matter in the final run.

RESEARCH AND DEVELOPMENT TECHNOLOGY BASE

Senator THURMOND. I have always backed up the Department of Energy in every way I could. There is a general feeling on the part of the public that if you want some other agency to oversee this matter, it would somewhat take the Department of Energy off the spot, too, if something should happen, and of course you pray to God that it does not.

Dr. Barker, from the standpoint of the Department of Defense, do you attach a high priority to satisfying near-term weapons production requirements or maintaining a viable technology in a production base for nuclear weapons?

Dr. BARKER. The Department of Defense believes it is very important that a vital and active research and development activity be maintained while nuclear weapons production proceeds.

Senator THURMOND. Admiral Foley, what importance do you attach to full funding for inertial confinement fusion research if Congress puts additional budget pressure on your research programs?

Admiral FOLEY. Sir, I support inertial confinement fusion research as a high priority. I do not support putting a fence around that money and excluding it from the overall technology base, the core base in the laboratories.

I think it should be part and parcel of the ongoing aggregate research and development within the laboratories. It limits the flexibility of the laboratory directors, sir, when specific moneys are funded for ICF and we have to take adjustments or modify the overall program. The ICF program should be hit just like anything else, if that needs to be done.

So I am opposed to a fence around that money.

WEAPONS TESTING

Senator THURMOND. Admiral Foley, can you comment on the relationship of the funding request to the number of tests?

Admiral FOLEY. Yes, sir. The number of tests that we conduct right how is a function of the funding levels.

If we had our choice, if our bomb designers and our laboratory directors and the program of priorities that we have were to be carried out, we would conduct more tests than we do today.

So, the fiscal constraints are what drive the number of tests that we are doing.

It stretches out the accomplishments of some of our modernization programs and the series of tests that I have pointed out.

We have asked for [deleted] tests in 1987 and about that same number in 1988. We would conduct more if we could, sir, but the funding is not there.

Senator THURMOND. Dr. Barker.

Dr. BARKER. May I interject on this last question that the Department of Energy is asked to maintain nuclear weapons for about 30 different weapons systems. This burden has been unchanged for the last several decades.

The Department of Energy is maintaining that deterrent. It is looking to the modernization of that deterrent, to pursing the tech-

nologies necessary for the future with a test program that is substantially less than what it was two decades ago.

It has been able to do that in part because of the tremendous accomplishments of the Department of Energy laboratories in the computer technology area, but that does not explain the entire difference.

In part, the test program has been reduced solely because of the fiscal constraints that have been imposed upon it. I personally believe that any reduction in testing below its current levels would be tragic as far as our ability to maintain a credible deterrent is concerned.

ANTISUBMARINE WEAPONS

Senator THURMOND. Dr. Barker, what is the level of funding included in the fiscal year 1988 and fiscal year 1989 budgets for development of warheads for the ASW standoff weapons, and a replacement for the nuclear depth bomb?

Dr. BARKER, I am going to have to look to Admiral Foley for some help on that question, Senator.

Admiral FOLEY. To the best of my knowledge, sir, that particular line item was zeroed out by the Congress in the fiscal year 1987 budget.

Dr. BARKER. You have touched upon a very critical issue, I think, Senator Thurmond, because the Navy tactical nuclear weapons stockpile is probably the oldest fraction or close to the oldest fraction of our nuclear deterrent today. Every time modernization of the anitsubmarine warfare or standoff weapon capability is addressed, for one reason or another, it gets pushed off, postponed, or delayed. We are seeing the same thing happen in this area at this time.

Senator THURMOND. Admiral Foley, what progress has the Department made in facilitating applications for release of technical data for commercial exploitation?

Admiral FOLEY. The legislation is quite clear on what can be done. We have implemented it, particularly with regard to the laboratories, and we address it on a case basis. It seems to me that there have been some comments or complaints over the last year about the speed with which we could accomplish this. The speed has ranged anywhere between as short as a 3-week period of time out to as long as a couple of years.

So, I am saying that I think the legislation is quite adequate, that which is there right now, in terms of putting the patents out into the private domain from the laboratories. It is a case of aggressively implementing the legislation that is there.

We had a meeting with our laboratory directors, and I think that we have improved our procedures during this past year. We seem to be moving along at a good clip right now, sir.

SRAM II WARHEAD

Senator THURMOND. Dr. Barker, what are the arguments for and against a new design warhead instead of a modified existing warhead for the SRAM II missile?

Dr. BARKER. This is an issue which has received extensive attention during the past year, and a study is on its way to you from the Department of Defense addressing both a modernized or refurbished missile as well as the warhead issue.

The existing SRAM warhead was the state-of-the-art at the time it was deployed. It does not include modern safety and security features, and [deleted].

Today, we have the technology to produce comparable yields [deleted]. And so, using the existing warhead would be a travesty of everything that is important in that it would ignore safety, security, [deleted].

A fully modern warhead, of course, would provide the state-of-the-art in all of these features. [Deleted.]

We looked at that.

The Department of Energy was asked to examine such a possibility, using as many features from an existing design as possible. The cost data provided to the Department of Defense by the Department of Energy indicated essentially no difference between a modified existing warhead and an all new warhead.

There were certain features about an all new warhead that made it clearly the most attractive choice, namely better packaging and also the [deleted.]

So, we have studied it thoroughly, and I think we have convinced ourselves, and can convince you in as much detail as you would like, that the right solution is a new warhead for that system.

STRATEGIC DEFENSE INITIATIVE FUNDING

Senator THURMOND. Admiral Foley, what steps has the Department taken to identify the proportional level of effort and activities at the national laboratories that are associated with SDI?

Are you confident that you are accounting for all SDI related activities in a consistent manner throughout the Department of Energy?

Admiral FOLEY. I would say yes, sir, starting with the budget for fiscal year 1987 and moving on, that I am confident that we are accounting across-the-board in all of our activities, in all of our laboratories, for the SDI.

Prior to fiscal year 1987 we did not have in-place a formal fiscal mechanism—that is, there was no requirement for a finite amount to be spelled out for SDI. It was included within the research and development budget.

So, there was much more flexibility for the laboratories in that timeframe than there is now.

I am confident that the fiscal mechanisms for accounting that we have in place now will assure us that we have a very close handle on all the moneys being spent for SDI in all the laboratories.

Senator THURMOND. Dr. Barker, what future adjustments in the stockpile memorandum do you foresee necessitated by either budget constraints or the slower production of nuclear materials?

STOCKPILE MEMORANDUM REQUIREMENTS

Dr. BARKER. At the moment, Senator, the budget requests from the Department of Energy do permit the President's stockpile

memorandum to be met through the fiscal year 1988 and fiscal year 1989 budget cycle, [deleted] in the kind of timeframe indicated by Admiral Foley.

Beyond the fiscal year 1989, if the Presidential stockpile memorandum is to be met, we will face new requirements that will raise the spectre of substantial funding requirements. Those are issues that the executive and the legislative branch will have to deal with when the time comes.

At the moment, if the Department of Energy budget is approved as submitted, they will be able to meet the stockpile memorandum.

BUDGET CONSTRAINTS

Senator THURMOND. Admiral Foley, while the Congress currently approves the weapons program budget at a considerable level of detail, this committee has more interest in providing broad policy guidance and overall funding levels. What steps would you suggest to this committee in the interest of reducing the micro-management of the DOE request?

Admiral FOLEY. I smile a little bit at your question because it seems like one submitted by the Department of Energy rather than from the Congress, sir.

I do not characterize your oversight as micro-management. We have had a very good working relationship with the staffs, a give and take. Neither side is totally satisfied. But the committee has been very supportive of our budget.

I would point out that we need that support because those who attempt to legislate arms control or a reduction in arms are coming at the Department of Energy to reduce our budget rather than going after the Department of Defense. [Deleted.]

So I would ask that the Department of Energy Defense Programs budget remain intact, remain at our request, [deleted.]

I think what you are doing right now is just about right, sir. But I would ask that you not micro-manage us any more than you are currently doing.

Senator THURMOND. Personally, I think you need as much flexibility as you can get.

Admiral FOLEY. Yes, sir. This is particularly true for the inertial confinement fusion program. This is one thing that I pointed out. I would also ask one other thing. As you go into your very careful management of the budget, there will probably be requests for a lower amount. I think that is probably inevitable. You will be looking for some cuts.

I would ask that you give us the target, the amount that you need cut, and let us decide where best to take those cuts, rather than your imposing them on us.

Senator THURMOND. The able and distinguished ranking member of the committee is with us.

Senator Warner, do you have some questions?

Senator WARNER. I will offer a question or two, but I am always one step behind you, my leader.

Senator THURMOND. It is an honor to have you here.

NUCLEAR WEAPONS COUNCIL

Senator WARNER. Thank you.

Gentlemen, Senator Nunn and I put in legislation in 1987 which resulted in the President's Blue Ribbon Task Force, the BRTG, giving a report, and now I have just been handed the responses from the Secretaries of Defense and Energy.

You are familiar with that?

Admiral FOLEY. Yes, sir.

Dr. BARKER. Yes, sir.

Senator WARNER. Now I have not had a chance to look through it, but I hope you feel that this was a constructive effort on behalf initially of the Congress, then the President's Blue Ribbon Task Force, and that it stimulates the thinking within your own two departments, and that this will lead to a better allocation of the resources between the two departments for their programs.

Are there some general comments that you might wish to make about this.

Dr. BARKER. Senator Warner, I think that the fact that you personally and others in this body——

Senator WARNER. It was Chairman Nunn and I who were the two together who I believe started this.

Dr. BARKER. The fact that the concern existed indicated that things were not going quite right.

The mechanisms that you have set in place, both with the 1987 Authorization Act and the measures which have been implemented by the Nuclear Weapons Council created by that act, which are detailed in the report you have just been provided, do provide the basis for a mechanism which should be capable of alleviating the concerns you spoke of when the Blue Ribbon Task Group was first established.

Admiral Foley is one of the three members of the Nuclear Weapons Council, along with Under Secretary Godwin and General Herres, the Vice Chairman of the Joint Chiefs of Staff.

Those three gentlemen are the members. I am the director of the staff that supports the Nuclear Weapons Council and chairman of the group which is subordinate to it.

FUNDING TRADE-OFFS

The mechanisms are all in place to do the kinds of cost tradeoffs that the Senate indicated an interest in having performed. The mechanisms are in place to make sure that we do, indeed, examine conventional options when we replace any nuclear system. The mechanisms are in place to, very early on in the budget cycle for the Department of Energy, inform the Department of Defense as to where there may be budgetary mismatches.

So, I think the mechanism is in place now to address the problems which concern you.

If I can, I would return for a moment to the answer that Admiral Foley gave a moment ago to Senator Thurmond's question.

We can go through this planning process and try to create a balance of DOD and DOE resources that are necessary to meet a national security requirement. I would hope that the Senate, when it sits down and deals with what appears to the Senate to be two sep-

arate budgets, recognizes that they have been put together to create a balanced ability to meet our national security requirement. A blanket percentage cut across the board that affects both Defense and Energy may disturb that balance.

We have created it based upon the details, making sure that the Department of Energy budget can support defense requirements.

If one starts to take it apart, one needs to take it apart with equal care. I hope we can count on the Congress as well to do that.

Senator WARNER. Just a little bit of history may have some bearing on this.

I remember when I first came to the Senate. I went on a subcommittee as ranking member. I cannot remember the exact name of that committee, but essentially it handled this account, as well as some others. Scoop Jackson, whom we all revere and love to this day, used to say to me now, when it comes to this particular account, you and I can slip over to the Senate floor at around 5:00 o'clock and get it through in about 3 minutes. It really shot through just like that. No one paid much attention to it.

Then Senator Nunn and I chatted one day about it—well, you know, it's sort of like a Secretary of Defense is able to get whatever he wishes in this account, and sometimes he is restricted in other accounts.

That is just a little bit of background. But I think we are going to pay more attention to it over here now.

Admiral FOLEY. May I just comment on that issue, Senator Warner?

Senator WARNER. Of course.

Admiral FOLEY. It is a caution.

When you go to the Department of Defense with their aggregate budget of hundreds of billions of dollars, there are other avenues to get funds for the nuclear program. You can look at the different services, look at the different weapon systems, and then you can maneuver money around a little bit.

When you move over to the Department of Energy, two-thirds of the budget sits in defense programs. There is no place else to go to get money.

So, if you whack a percentage across the Department of Energy, the impact is considerably greater.

Senator WARNER. I agree, and I would expect nothing less from you, Admiral, having known you for many years. You are a tenacious fighter. We are fortunate to have you as our distinguished Secretary.

When I was on the Energy Committee—and I am doing too much reminiscing—as I recall, we had one Democrat and one Republican, and we used to lament the fact down there that that committee had nothing to say about this budget, yet it was devouring all the other programs.

Well, so much for that. Let us hope you achieve something here, and I look forward to your report with some interest.

I am also quite keen in following up on Senator Nunn's question about safety systems and whether or not there is a parallel among all three branches of the services having these systems. I understand that he laid the foundation for some series of questions. Perhaps a followup letter from the two of us could frame our concerns

so that the two departments can look to this, come back to the Congress, and hopefully provide us with the assurance that the safety procedures in the three military departments are equally as effective.

I have been handed a question here for Dr. Barker.

Are the two DOD members on the Nuclear Weapons Council as happy as Admiral Foley is? That is a very direct question.

Dr. BARKER. I believe so, Senator. The meeting of the three gentlemen was collegial, friendly, and I think it constituted a commitment on the part of all three to working the significant issues that involve the two departments.

I think it is fair to say that both of them are as enthusiastic as Admiral Foley about the Nuclear Weapons Council.

CHERNOBYL ACCIDENT REPERCUSSIONS

Senator WARNER. My last point is just again an observation.

Yesterday, we had some very interesting testimony before the full committee in the context of our hearings on national strategy. The distinguished former Chairman of the Joint Chiefs, General Jones, observed that in his recent trip to the Soviet Union, there is considerable thinking about Chernobyl and the tragedy that followed in the context of the possible—and I say "possible"—revision of Soviet military strategy.

There are some indications from statements made by Gorbachev and Ackhomeyev and others that perhaps they are shifting their emphasis from the nuclear systems to more emphasis on conventional systems because of the stark realities of what happened in Chernobyl, and that, of course, is a vastly reduced scale of anything that would occur from a military situation.

I wonder if you have had any indications, either of you, that this incident was affecting some thinking in the Soviet Union with respect to their nuclear strategy and emphasis on their nuclear systems.

Admiral FOLEY. I will address that rather quickly because Dr. Barker, who has had discussions with the Soviets face-to-face recently on four different occasions in Geneva, is probably well positioned to be able to make a comment.

Mine is strictly from the viewpoint of watching the Soviets at Chernobyl and in their most recent testing.

Clearly, the Soviets lack a safety conscience.

Chernobyl is a perfect example of that. I see now a reopening of the same category of reactors with no major modifications that I know of taking place.

[Deleted.]

So I am not optimistic or persuaded at this particular time that there is any great surge toward a movement.

I would welcome one, but I do not see it.

Senator WARNER. A surge in movement toward greater safety in terms of their private nuclear activities as opposed to military—is that your point?

Admiral FOLEY. Well, I would use one as an indication of perhaps the other. I see no movement toward it on the private side and, on the military side, it remains to be seen.

With that, I would yield to Dr. Barker.

Senator WARNER. Let me follow up with you for a moment, Admiral. I have two quick questions.

Are we able to equate or draw any parallels between Chernobyl and, say, the explosion of one of our tactical weapons—in other words, say an artillery 155.

Dr. BARKER. A study of that nature was done. I do not happen to remember the details, but we can certainly provide it to you.

Senator WARNER. Is there someone in the room accompanying either of you who can provide this, who might generally know what that study reveals?

Dr. BARKER. It is not a simple comparison because the rate of decay in the radioactivity associated with the two different kinds of devices is entirely different. So the relationship, if one compares Chernobyl to a nuclear yield, on the first day is one ratio, 10 days later it is a different ratio, and 6 months later still different.

Senator WARNER. I would be interested in looking at that study if you might make available to the committee a copy of it.

[The information follows:]

CHERNOBYL DISASTER COMPARISONS

No complete study that draws comparisons between the effects of the Chernobyl nuclear disaster and the effects of a nuclear explosion has been identified. Such comparisons are difficult, since most of the explosive energy of a nuclear weapon produces air blast (and shock), thermal radiation, and heat, none of which are major factors in a reactor accident. Comparisons can be made based on resulting radiation exposures at a given distance from either event, but such comparisons will depend greatly on the associated assumptions because of difference in radioactivity. Comparisons of the two scenarios will also depend on assumptions about the duration of individual exposures; i.e., whether individuals are evacuated, and if so, how long after exposure begins. Studies are continuing to attempt meaningful comparisons between such events.

ENVIRONMENTAL DAMAGE FROM CHERNOBYL

Senator WARNER. Second, do we now have a completed assessment of the damage inflicted to the environs, or is that an ongoing effort?

In other words, have we really determined the magnitude of the detrimental consequences on the environment and on the people?

Admiral FOLEY. It is ongoing, sir, particularly on the people. There have been varying studies and also opinions as to the long-term effects—the cancer-producing effects of the accident itself. There are differing opinions.

They range up to perhaps a thousand more people over a period of 20 years down to a minor impact. But there is an ongoing analysis within the Soviet Union and within the International Atomic Energy Administration of both sides, both environmental and medical.

Senator WARNER. Here is my last question on that.

This morning, Senator Levin and I hosted a parliamentary delegation from Europe. Part of our discussion related to Chernobyl, and the United Kingdom representatives indicated that they were now monitoring the detrimental effects in the United Kingdom.

Is there documentation now that some detrimental effects have occurred in the United Kingdom? What is the longevity?

Dr. BARKER. Well, I think throughout Europe——

Senator WARNER. Well, I don't doubt that it goes throughout Europe.

Dr. BARKER. There have been very considerable efforts made to monitor the radioactivity.

As you are well aware, I think tons and tons of foods were thrown away because of the contamination, such as leafy vegetables, and I guess there was a significant impact on the Finnish economy in terms of fruits and other items. I believe even reindeer meat and milk were contaminated.

The impact is significant.

The question is how much of that by one way or another got into human beings, because there was a tremendous effort to keep those foodstuffs out of the human food cycle.

For this very reason, I am not sure we will ever know because, I think, there were stories in the papers a couple of weeks ago about items parked on a railroad siding that were being sold, or that people were planning to start selling these items in Africa.

We will never know the full impact of that whole thing.

SOVIET SAFETY CONSCIOUSNESS

I want to go back to one of Bob Foley's earlier statements about what has the impact been on the Soviet safety conscience.

Senator WARNER. Yes, and whether or not the lessons from Chernobyl are in any way effecting their reassessment of the military.

Dr. BARKER. Senator, I have to feel that after 18 months of cessation of their nuclear testing, for their first test to vent radioactivity, [deleted] is indicative of a not very significant change in attitude.

The Soviets are clearly not ready to undertake the same kind of fiscal penalty that the Department of Energy has paid in order to insure that radioactivity will not vent. It really is a matter of money and planning.

They can plan those tests in a place where the tests can be contained. They can bury them at a depth that will be contained, but, so far, they have not seen the necessity to do that.

Now, all we know about are those tests which vent and where the radioactivity goes outside the Soviet borders. We don't know how many more tests vent and the radioactivity stays within the Soviet Union.

So I think that one event, in and of itself, after Chernobyl—let me say that I must admit that we have known all along about the Soviet venting. It is the reason for the President's charge of Soviet noncompliance with the provisions of the Limited Test Ban Treaty.

When the General Secretary of the Soviet Union decided to continue his moratorium after Chernobyl and he extended it yet one more time in August, it was part of my wondering at the time if maybe he was not postponing it with the idea that if he vented so soon after Chernobyl, would he not have tremendous problems with the world. But I also thought he might, then, order that steps be taken to insure that such venting would never occur again. He has not done that.

I cannot see any change in attitude.

Senator WARNER. Thank you.

Mr. Chairman, I thank you for your courtesy in permitting me these questions and I thank the witnesses for their reply.

Senator THURMOND. Thank you for your contribution, Senator.

I want to say to the witnesses that if you feel the need to respond your answers of any of the questions that we have asked you, please feel free to do that.

Dr. BARKER. Thank you.

Admiral FOLEY. Thank you very much.

[Questions for the hearing record with answers supplied, follow:]

QUESTION SUBMITTED BY SENATOR SAM NUNN

BLUE RIBBON TASK GROUP RECOMMENDATIONS

Senator NUNN. Admiral Foley, one of the Blue Ribbon recommendations was not to include R&D costs in the process of nuclear weapons tradeoff analysis, on the grounds that the weapons R&D is a "level-funded activity." Yet the weapons R&D effort does not appear to have shrunk as other, related activities in, for example, inertial confinement fusion and the x-ray laser part of SDI, have increased. Given this phenomenon, why should we continue to view the nuclear weapons R&D as a "level-of-effort" activity?

Admiral FOLEY. The Blue Ribbon Task Group was referring to research, development, and testing costs associated with individual weapons. The total of these costs for all specific weapons programs is shown in the budget as Weapons Development Engineering and Certification (WDEC), which is a subset of the Research, Development, and Testing Core Program. As the demand for WDEC effort fluctuates with individual weapons programs, the other major subset of the Core Program, Technology Base Activities, also varies. The totals of WDEC and technology base activities comprise a relatively stable level of effort.

NEW LEGISLATIVE INITIATIVES

Senator NUNN. Could you briefly call to the Subcommittee's attention any new legislation introduced into the 100th Congress that in your judgment, bears on DOE programs, budgets, or operations?

Admiral FOLEY. There are several bills that have been submitted by the 100th Congress having some effect on Defense Programs activities. This list by topic, bill number, and sponsor is shown below.

STOCKPILE/TESTING

H.R. 12 (Schroeder) To provide for a mutual, simultaneous, and verifiable moratorium on testing nuclear warheads.

H.R. 347 (Dicks) To limit deployment and maintenance of U.S. strategic nuclear weapons consistent with existing arms limitation agreements.

H.J. Res. 4 (Kastenmeier) Calling for a verifiable comprehensive treaty banning testing production deployment and use of all space based weapons for use against space, air or ground targets and ground based on air based weapons for use against safe satellites and dismantling of existing weapons systems.

H.J. Res. 74 (Neal) To express the sense of Congress that the President should immediately resume negotiations with the Soviet Union and Great Britain on a comprehensive treaty to end the testing of nuclear weapons, and that the President should seek to include negotiations with all other nuclear and nonnuclear weapons nations.

AuCoin Amendment to House Appropriations Bill "Limitations on Nuclear Testing."

S. 16 (Byrd) To facilitate U.S. compliance with certain numerical limitations governing strategic nuclear weapons.

S. 472 (Cranston) To provide for a mutual, simultaneous, and verifiable moratorium on the testing of nuclear warheads.

S. 1106 (Hatfield) A bill to provide for simultaneous, mutual and verifiable moratorium on underground nuclear explosions above a low yield threshold.

ATOMIC VETS

H.R. 688 (Roybal) To provide for payment by the U.S. for certain medical services and treatment provided to U.S. citizens and permanent residents suffering from physical injuries attributable to the atomic bomb explosions on Hiroshima and Nagasaki, Japan, in August 1945.

H.R. 1811 (Rowland) A bill to provide benefits to veterans and survivors of veterans who participated in atmospheric nuclear tests or the occupation of Hiroshima and Nagasaki and who suffer from diseases that may be attributable to low levels of ionizing radiation.

S. 453 (Murkowski) "The Veterans' Ionizing Radiation Compensation Act".

S. 478 (Simon) To repeal section 1631 of the Department of Defense Authorization Act, 1985, relating to the liability of Government contractors for injuries or losses or property arising out of atomic weapons testing programs, and for other purposes.

S. 1002 (Cranston) A bill to amend title 38, U.S.C., to provide disability and death benefits to veterans (and survivors of such veterans exposed to ionizing radiation during the detonation of a nuclear device in connection with the U.S. nuclear weapons testing program or the American occupation of Hiroshima or Nagasaki, Japan.

ENVIRONMENT

H.R. 1 To amend the Federal Water Pollution Control Act to provide for renewal of the quality of the Nation's water.

H.R. 783 (Wyden) A bill to require the Secretary of Energy to ensure the compliance of certain operations of the Department of Energy with Federal environmental standards, and for other purposes.

H.R. 2047. (Dicks) To establish a Defense Nuclear Facilities Safety Agency in order to provide for increased standards of safety with respect to radioactive emissions resulting from activities carried out at nuclear facilities of the DOE.

S. 20 (Moynihan) The Ground Water Protection Act of 1987.

S. 1085 (Glenn) A bill to create an independent overview board to ensure the safety of U.S. Government nuclear facilities, to apply the provisions of OSHA to certain Department of Energy nuclear facilities, to clarify the jurisdiction and powers of Government agencies dealing with nuclear wastes, to ensure independent research on the efforts of radiation on human beings, and for other purposes.

HIGH-LEVEL WASTE

H.R. 1252 (Gregg) To amend the Nuclear Waste Policy Act of 1982 to remove the requirements for a second repository for disposal of HLW and spent nuclear fuel.

H.R. 1185 (Snowe) To amend the Nuclear Waste Policy Act to provide for disposal of HLW and spent fuel in a single repository.

SAFETY

H.R. 2047 (Dicks) To establish a Defense Nuclear Facilities Safety Agency in order to provide for increased standards of safety with respect to radioactive emissions resulting from activities carried out at nuclear facilities of the DOE.

H.R. 706 (Udall) A bill to amend the Energy Reorganization Act of 1974 to create an independent Nuclear Safety Board.

S. 79 (Metzenbaum) A bill to notify workers who are at risk of occupational disease in order to establish a system for identifying and preventing illness and death of such workers, and for other purposes.

S. 40 (Moynihan) A bill to amend a section of the Atomic Energy Act of 1954 to clarify that no nuclear plants should operate without assurance from the Federal Government's experts on emergency preparedness, that the public health and safety can and will be protected.

H.R. 162 (Gaylor) To establish a system for identifying, notifying, and preventing illness and death among workers who are at increased or high risk of occupational disease.

TRANSPORTATION

H.R. 1646 (Green) To restrict the transport of Radioactive Materials through high density areas.

H.R. 1649 (Gunderson) No person may offer any high-level radioactive waste for transportation unless licensed by NRC.

H.R. 895 (Duncan) To amend the Hazardous Materials Transportation Act to provide for the registration of hazardous materials carriers, and to provide assistance in routing hazardous materials and in the training of personnel.

S. 833 (Hecht) A bill entitled "Nuclear Waste Transportation Prohibition Through Urbanized Areas Act of 1987."

S. 1008 (Proxmire) A bill to provide for State Regulation of the transportation of high-level radioactive waste.

H.R. 2118 (Buechner) A bill to amend the Hazardous Materials Transportation Act to place certain restrictions on the transportation of radioactive waste.

MATERIALS PRODUCTION

H.R. 1135 (Wyden) To amend the Atomic Energy Act to prohibit the conversion of certain nuclear facilities from civilian nuclear purposes to military purposes.

CONTRACTOR LIABILITY

S. 612 (Simon) A bill to repeal a provision of the Federal Tort Liability Law relating to the civil liability of government contractors for certain injuries, losses of property and deaths, and for other purposes.

S. 748 (Johnston) A bill to amend the Atomic Energy Act to establish a comprehensive, equitable, reliable, and efficient mechanism for full compensation of the public in the event of an accident resulting from activities undertaken under contract with the Department of Energy involving nuclear materials.

S. 44 (Moynihan) A bill to amend the Atomic Energy Act of 1954 to establish a comprehensive, equitable, reliable and sufficient mechanism for full compensation of the public in the event of an accident arising out of activities of the NRC, the Nuclear Waste Policy Act of 1982 involving nuclear materials, and to reduce the likelihood of such an accident.

H.R. 2141 (Eckart) to amend the Price-Anderson provisions of the Atomic Energy Act to provide for unlimited liability in the event of an accident at a nuclear power plant, and for other purposes.

H.R. 1414 (Udall) A bill to amend the Price Anderson provisions of the Atomic Energy Act of 1954 to extend and improve the procedures for liability and indemnification for nuclear incidents.

NUCLEAR ARTILLERY SHELLS

Senator NUNN. What is the progress on the withdrawal of the old 8-inch nuclear artillery shells from Europe in order to recover their critical nuclear materials?

Dr. BARKER. Consistent with the October 1983 Montebello decision and SACEUR's Nuclear Weapons Requirements Study 1985, the withdrawal of the old 8-inch nuclear artillery warheads (W33) from Europe is linked to the improved credibility of deterrence at lower overall numbers of warheads achieved by the introduction of modernized non-enhanced radiation warheads (W79). Recovery of the special nuclear material (SNM) in the W33 warheads is an important corollary. By the end of fiscal year 1987, [deleted] of the older W33 8-inch warheads will have been withdrawn from Europe over the past two years, as modernized W79-0 (non-enhanced radiation) 8-inch warheads have been deployed on a less than one-for-one replacement basis. The Department of Energy has made provisions for the recovery of the SNM in the retired W33 components. As has been indicated on several occasions, it will be necessary to retain a number of the older artillery fired atomic projectiles (AFAPs) in our inventory to meet and maintain the JCS approved worldwide stockpile level of [deleted] Under the Nunn-Johnston ceiling of 925 modernized warheads, all [deleted] W79 8-inch nuclear warheads have been produced. There are no plans to seek production of additional W79 8-inch warheads. The current plan (in the absence of arms control considerations) is to retire an additional [deleted] W33 warheads within the next three years. Since the worldwide requirements for 8-inch warheads exceed the number of modernized W79 8-inch warheads available, the current plan is to retain [deleted] of the older W33 warheads for the foreseeable future. The [deleted] W82 155mm warheads currently authorized will permit the retirement of more than that number of W48 warheads. However, the [deleted] W82 warheads will not meet worldwide requirements and will permit neither retirement of all of the older W48 155mm warheads nor replacement of the remaining W33 8-inch warheads.

Senator THURMOND. Also, I have an opening statement which I ask be placed in the record at the appropriate point at the beginning of this hearing.

I want to express my appreciation to both our witnesses.

I think we are very fortunate to have people like you in the Government. I think you are both doing a fine job and we look forward to working with you.

Thank you very much.

Admiral FOLEY. Thank you very much.

Dr. BARKER. Thank you, Senator Thurmond.

Senator THURMOND. We now stand adjourned.

[Whereupon, at 11:28 a.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

WEDNESDAY, APRIL 1, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

SDI RESEARCH AND ITS COMPLIANCE WITH THE EXISTING TREATY OBLIGATIONS

The subcommittee met in open session, pursuant to notice, at 9:18 a.m., in room SD–106, Dirksen Senate Office Building, Senator James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Bingaman, Glenn, Gore, Thurmond, Warner, Cohen, Wilson, Humphrey, Quayle, and McCain.

Staff present: Carl M. Smith, staff director for the minority; Robert G. Bell, Robert F. Bott, William E. Hoehn, Jr., Ronald P. Kelly; professional staff members; Colleen M. Getz, research assistant; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Gregory B. Craig, assistant to Senator Kennedy; Edward M. McGaffigan, Jr., assistant to Senator Bingaman; Milton D. Beach and Donald A. Mitchell, assistants to Senator Glenn; Leon Fuerth, assistant to Senator Gore; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; Henry D. Sokolski, assistant to Senator Quayle; Mark J. Albrecht, assistant to Senator Wilson; Patrick A. Putignano, assistant to Senator McCain.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order.

The Subcommittee on Strategic Forces and Nuclear Deterrence meets this morning for the 16th of its scheduled hearings to receive testimony in open session on the Strategic Defense Initiative and on the compliance of SDI research programs for fiscal years 1988 and 1989 with all applicable arms control treaties to which the United States is a party.

There have been several private discussions and several closed meetings on this subject, and we are just awfully glad to have our expert witnesses here this morning to testify further in open session.

We will hear from two witnesses this morning.

First is the Honorable Richard Godwin, the Under Secretary of Defense for Acquisition and the DOD individual responsible for the certification of compliance of SDI research programs with treaties.

Our other witness is Lt. Gen. James A. Abrahamson, the director of the SDI Organziation.

Welcome to both of you gentlemen this morning.

I understand that Mr. Godwin has a schedule conflict that will require his departure promptly at 11 a.m. The subcommittee is more than glad to accommodate him. We will ask him to open the testimony this morning, and then, if possible, we will go to a quick first round of questions and then follow with the other witness.

The Subcommittee on Strategic Forces and Nuclear Deterrence met with General Abrahamson a week or so ago in closed session to allow him to discuss certain classified aspects of SDI research in great detail. I believe that he was very useful and very forthcoming in that session, and focused on the programmatic details of SDI today.

I would hope that the members of the subcommittee could focus primarily on the issues of arms control policy, including compliance matters, the potential role of strategic defense in our deterrent posture, and the criteria that should be used by Congress in considering the SDI budget request.

The SDIO is requesting $5.2 billion in fiscal year 1988 and $6.2 billion in fiscal year 1989 in the DOD budget, and $569 million in fiscal year 1988 and $390 million in fiscal year 1989 in the Department of Defense energy budget. The combined fiscal year 1988 request of $5.8 billion represents a gross increase of about 66 percent over the level appropriated for fiscal year 1987, not counting the additional funds requested in the fiscal year 1987 supplemental.

This substantial increase in the request has occurred against a backdrop of hints of imminent decisions to commit to a partial deployment of some sort which has still not been fully explained to the Congress in any detail, and in the midst of a continuing controversy over the interpretation of the provisions of the ABM Treaty.

Thus, SDI will continue to be one of the most controversial issues that our subcommittee will have to address.

This Senator has always supported a robust SDI research program designed to explore the technical feasibility of highly effective defenses. But I must say that, in my judgment, both the push for an early deployment decision and the fight over treaty interpretation cannot have any positive effect on this overall effort and could erode congressional support for a solid, prudently placed and long-term SDI research program.

I will now go to the first witness of the day.

Mr. Godwin, we are pleased to allow you to proceed with your testimony, with the agreement of General Abrahamson. Would you please proceed.

STATEMENT OF HON. RICHARD P. GODWIN, UNDER SECRETARY OF DEFENSE FOR ACQUISITION, ACCOMPANIED BY LEE MINICHIELLO, CHAIRMAN, DEPARTMENT OF DEFENSE COMPLIANCE REVIEW GROUP

Mr. GODWIN. Thank you, Mr. Chairman and members of the committee.

I would like to summarize briefly my statement for the record.

I am here today to provide a compliance assessment of the Department of Defense's Strategic Defense Initiative (SDI) activities through fiscal year 1989.

I will summarize the DOD process for assessing and assuring compliance and then discuss the assessment of the compliance for planned SDI activities.

But first, let me describe my role in the SDI acquisition process.

As the Defense acquisition executive, my responsibilities include oversight of the DOD acquisitions. We are currently in the process of bringing SDI into the acquisition system.

A milestone review of this program is planned soon. We intend to apply the same standards and criteria to SDI that we do to other major weapon systems in the Department of Defense.

In addition to my role of Defense acquisition executive, I also have the responsibility to provide oversight on implementation of these compliance procedures and to monitor overall compliance. My office issues instructions and guidance on compliance issues on a case-by-case basis and reviews the services' and defense agencies' compliance assessments.

A Compliance Review Group assists me with this process. It is chaired by Mr. Lee Minichiello, who is on my right, and whom I would like to introduce to this committee at this time.

As the chairman, he supervises the overall operations of the committee. The committee consists of knowledgeable officials from acquisition, general counsel, policy, and the Joint Chiefs of Staff. The Compliance Review Group insures that no program, experiment, or project that reasonably raises an issue of compliance can proceed until the issues are resolved and approval is given by my office.

In assessing DOD compliance on the SDI experiment, we evaluate the experiments based on one of three types of development and testing activities permitted by the ABM Treaty.

Category I activities involve conceptual design or laboratory testing.

Category II involves field testing of devices that are not ABM components, prototypes of ABM components, or otherwise capable of substituting for ABM components. Such devices must not be capable of substituting for ABM components or tested in the ABM mode. These criteria are used in reviewing all Category II tests.

A more detailed discussion of Category II is included in my statement, which I have submitted for the record.

Senator EXON. Without objection, it will be included.

Mr. GODWIN. Category III involves field testing of fixed, land-based ABM components. These tests are permitted as long as other treaty provisions are met.

The President has directed that the department's SDI activities be conducted according to a restrictive interpretation of the ABM Treaty. Consequently, our assessment on all SDI activities is based on the restrictive interpretation and each SDI experiment is evaluated for compliance against this restrictive interpretation.

The SDI Organization plans to conduct nine major experiments between now and the end of fiscal year 1989.

Two of these experiments fall into Category I and the remaining seven fall into Category II. Descriptions of each experiment and our assessment of compliance are discussed in my statement for the record.

In summary, the provisions of the ABM Treaty permit certain types of ABM development and testing activities. Within these testing and development bounds, each SDIO experiment has been and will continue to be carefully evaluated to insure ABM Treaty compliance.

Mr. Chairman, that concludes my prepared remarks.

[The prepared statement of Mr. Godwin follows:]

PREPARED STATEMENT OF HON. RICHARD P. GODWIN

UNDERSECRETARY OF DEFENSE FOR ACQUISITION

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE

I APPRECIATE THE OPPORTUNITY TO APPEAR BEFORE THE COMMITTEE TODAY TO DISCUSS THE COMPLIANCE OF THE STRATEGIC DEFENSE INITIATIVE RESEARCH PROGRAM WITH THE ABM TREATY. IN RESPONSE TO YOUR REQUEST, I WILL ADDRESS SDI ACTIVITIES FOR THE PERIOD EXTENDING THROUGH THE END OF FY 1989. I SHOULD QUICKLY NOTE THAT THE RESEARCH PROGRAM IS ALSO REVIEWED FOR COMPLIANCE IN THE YEARS FARTHER OUT. WE PROVIDE THE CONGRESS WITH AN ANNUAL ASSESSMENT OF THE COMPLIANCE OF THE ENTIRE SDI RESEARCH PROGRAM AS PART OF THE REPORT TO CONGRESS ON THE STRATEGIC DEFENSE INITIATIVE.

I WILL DISCUSS THE COMPLIANCE PROCESS INCLUDING MY OVERSIGHT ROLE, PERMITTED RESEARCH AND DEVELOPMENT ACTIVITIES, AND THE COMPLIANCE ASSESSMENT OF SDI PROGRAMS.

THE DEPARTMENT OF DEFENSE COMPLIANCE PROCESS

I RECOGNIZE THAT EFFECTIVE ARMS CONTROL REQUIRES THAT COMPLIANCE BE TAKEN SERIOUSLY AND WILL ENDEAVOR TO SEE THAT THIS IS DONE. THE U.S. RECORD OF COMPLIANCE IS DEEPLY ROOTED IN ITS OWN LEGAL SYSTEM, AND A SET OF FUNDAMENTAL PRINCIPLES AND VALUES WHICH GOVERN AMERICAN ATTITUDES TOWARD BOTH ARMS CONTROL AND INTERNATIONAL OBLIGATIONS. UNDER THE U.S. CONSTITUTION, TREATIES ARE THE "LAW OF THE LAND" AND THUS BIND THE U.S. TO COMPLY WITH THEIR PROVISIONS. INTERNATIONAL LAW FURTHER REQUIRES ADHERENCE TO ALL TREATIES TO WHICH A SOVEREIGN NATION IS PARTY. THESE FACTORS--A DEEP-SEATED LEGAL TRADITION, A COMMITMENT TO ARMS CONTROL AGREEMENTS THAT CAN ENHANCE OUR

SECURITY AND THAT OF OUR ALLIES, AND THE WORKINGS OF AN OPEN SOCIETY--ARE BASIC AND ENDURING. THEY CREATE POWERFUL INCENTIVES TO COMPLY WITH AGREEMENTS TO CONTROL NUCLEAR AND OTHER WEAPONS. LEGAL AND INSTITUTIONAL PROCEDURES TO ENSURE COMPLIANCE HAVE BEEN ESTABLISHED, AND THEY REFLECT THE SERIOUSNESS WITH WHICH THESE OBLIGATIONS ARE TAKEN, AND REINFORCE THESE UNDERLYING PRINCIPLES.

THE UNDER SECRETARY OF DEFENSE FOR ACQUISITION (USD(A)) IS RESPONSIBLE FOR MONITORING AND ENSURING COMPLIANCE OF DOD PROGRAMS. AT THE TIME THE INITIAL GOVERNING DIRECTIVE WAS WRITTEN THE POSITION WAS CALLED DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING (DDR&E).

MY RESPONSIBILITIES INCLUDE: (1) ISSUING INSTRUCTIONS AND PROCEDURES FOR COMPLIANCE, (2) RENDERING SPECIFIC GUIDANCE ON ANY PROGRAM WHICH RAISES COMPLIANCE ISSUES, (3) REVIEWING QUARTERLY COMPLIANCE REPORTS FROM EACH OF THE U.S. ARMED SERVICES AND DESIGNATED DOD AGENCIES AND, (4) SUBMITTING PERIODIC REPORTS ON COMPLIANCE TO THE SECRETARY OF DEFENSE. I HAVE AUTHORITY TO CONDUCT "INSPECTIONS" AS NEEDED TO ENSURE COMPLIANCE. IT SHOULD BE NOTED THAT MY RESPONSIBILITIES ARE STRICTLY TO IMPLEMENT COMPLIANCE. POLICY DECISIONS REGARDING COMPLIANCE ARE MADE BY THE PRESIDENT AND ARE NOT PART OF MY IMPLEMENTATION FUNCTION.

THE DOD COMPLIANCE REVIEW GROUP (CRG), ASSISTS ME IN FULFILLING MY COMPLIANCE DUTIES. THE CRG HAS REPRESENTATIVES FROM THE DOD GENERAL COUNSEL, THE UNDER SECRETARY OF DEFENSE FOR POLICY, AND THE JOINT CHIEFS OF STAFF AS WELL AS ACQUISITION. THE DOD GENERAL COUNSEL'S PARTICIPATION IS IN ACCORDANCE WITH THE IMPLEMENTING DIRECTIVE WHICH ASSIGNS HIM THE RESPONSIBILITY FOR PROVIDING ADVICE AND ASSISTANCE WITH RESPECT TO THE

IMPLEMENTATION OF THE COMPLIANCE PROCESS AND INTERPRETATION OF ARMS CONTROL AGREEMENTS.

THE SERVICE SECRETARIES, CHAIRMAN OF THE JOINT CHIEFS OF STAFF AND AGENCY DIRECTORS ENSURE THE INTERNAL COMPLIANCE OF THEIR RESPECTIVE ORGANIZATIONS. THIS SECOND LAYER OF COMPLIANCE OVERSIGHT PROVIDES ADDITIONAL ASSURANCE OF COMPLIANCE AND GIVES DIRECTION TO THE FIELD. THE SERVICES AND DEFENSE AGENCIES MUST CERTIFY QUARTERLY TO THE USD(A) THAT THEIR PROGRAMS ARE IN COMPLIANCE AND MUST ESTABLISH INTERNAL PROCEDURES AND OFFICES TO MONITOR AND ENSURE THIS COMPLIANCE.

DOD INSTRUCTION S-5100.72 ESTABLISHES GENERAL INSTRUCTIONS, GUIDELINES, AND PROCEDURES FOR ENSURING THE CONTINUED COMPLIANCE OF ALL DOD PROGRAMS WITH EXISTING ARMS CONTROL AGREEMENTS. UNDER THESE PROCEDURES, QUESTIONS OF INTERPRETATION OF SPECIFIC AGREEMENTS ARE TO BE REFERRED TO THE USD(A) TO BE RESOLVED ON A CASE-BY-CASE BASIS. NO PROJECT OR PROGRAM WHICH REASONABLY RAISES AN ISSUE AS TO COMPLIANCE CAN ENTER INTO THE TESTING, PROTOTYPE CONSTRUCTION, OR DEPLOYMENT PHASES WITHOUT PRIOR CLEARANCE FROM THE USD(A). IN CONSULTATION WITH THE DOD GENERAL COUNSEL, OASD/INTERNATIONAL SECURITY POLICY AND OJCS, THE USD(A) APPLIES THE PROVISIONS OF THE AGREEMENTS AS APPROPRIATE.

SDIO IS A NEW ORGANIZATION WHICH HAS BEEN BROUGHT UNDER THIS FORMAL COMPLIANCE PROCESS. SDIO AND USD(A) AGREED THAT ALL SDI EXPERIMENTS WOULD BE REVIEWED FOR COMPLIANCE. SDIO HAS ESTABLISHED IN ITS GENERAL COUNSEL'S OFFICE A COMPLIANCE OVERSIGHT FUNCTION. THE COMPLIANCE REVIEW GROUP WORKING WITH SDIO REVIEWS THE ENTIRE SDI PROGRAM CONTINUOUSLY AND MAKES AN ANNUAL REPORT. THIS ANNUAL COMPLIANCE REPORT IS REVIEWED AND APPROVED BY ALL APPROPRIATE GOVERNMENT AGENCIES AND SUBMITTED TO THE CONGRESS.

THE DELTA 180 EXPERIMENT CAN BE CONSIDERED AS AN EXAMPLE OF HOW THE COMPLIANCE PROCESS WORKS. THE SDIO APPROACHED USD(A) WHEN THE PLANNING FOR DELTA 180 WAS BEGUN. USD(A) PROVIDED THEM GUIDANCE ON WHAT WERE PERMISSIBLE ACTIVITIES IN SUCH A SPACE-BASED EXPERIMENT. THE SDIO IN TURN DEVELOPED AN EXPERIMENT THAT DID NOT INVOLVE AN INTERCEPTOR THAT WAS ABM CAPABLE OR TEST CONDITIONS WHICH COULD BE CONSIDERED TO BE TESTED IN AN ABM MODE. THE DOD COMPLIANCE REVIEW GROUP OBTAINED USD(A) (THEN USDR&E) APPROVAL AND WORKED WITH SDIO TO BRIEF OTHER CONCERNED AND RELEVANT AGENCIES TO OBTAIN ADMINISTRATION APPROVAL OF THE EXPERIMENT.

POLICY REGARDING ABM TREATY COMPLIANCE

THE SDI RESEARCH PROGRAM IS BEING CONDUCTED IN A MANNER FULLY CONSISTENT WITH ALL U.S. TREATY OBLIGATIONS AS THE PRESIDENT HAS DIRECTED. THE DOD HAS PLANNED AND REVIEWED THE PROGRAM (AND WILL CONTINUE TO DO SO) TO ENSURE THAT IT REMAINS COMPLIANT.

ALSO BY DIRECTION OF THE PRESIDENT, AS A MATTER OF POLICY THE SDI PROGRAM HAS NOT BEEN RESTRUCTURED TO TAKE ADVANTAGE OF THE BROADER INTERPRETATION OF THE ABM TREATY WHICH THE PRESIDENT DETERMINED TO BE FULLY JUSTIFIED. THEREFORE, CONDUCT OF THE PROGRAM IS IN ACCORDANCE WITH A RESTRICTIVE INTERPRETATION OF THE TREATY. THIS RESTRICTIVE INTERPRETATION TREATS ABM DEVICES BASED ON OTHER PHYSICAL PRINCIPLES AND CAPABLE OF SUBSTITUTING FOR ABM INTERCEPTOR MISSILES, ABM LAUNCHERS, OR ABM RADARS AS "ABM COMPONENTS" WITHIN THE MEANING OF ARTICLE II OF THE TREATY, AND, THEREFORE, SUBJECT TO THE RESTRICTIONS OF THE TREATY, INCLUDING THE ARTICLE V BAN ON DEVELOPMENT AND TESTING OF ABM SYSTEMS AND COMPONENTS OTHER THAN IN A FIXED LAND-BASED MODE.

CONSEQUENTLY, ALL STATEMENTS IN THIS TESTIMONY REGARDING COMPLIANCE WITH TREATY PROVISIONS SHOULD BE UNDERSTOOD AS BASED ON THE RESTRICTIVE INTERPRETATION. THE PRESIDENT HAS RESERVED THE RIGHT TO RESTRUCTURE THE SDI PROGRAM TO TAKE FULL ADVANTAGE OF ALL U.S. RIGHTS UNDER THE ABM TREATY.

PERMITTED RESEARCH AND DEVELOPMENT ACTIVITIES

FIRST, IT SHOULD BE NOTED THAT NOWHERE DOES THE ABM TREATY USE THE WORD "RESEARCH." NEITHER THE U.S. NOR THE SOVIET DELEGATIONS TO THE SALT I [STRATEGIC ARMS LIMITATION TALKS] NEGOTIATIONS BELIEVED THAT IT WAS POSSIBLE TO VERIFY LIMITATIONS ON RESEARCH. IN FACT, NEITHER SIDE WISHED RESEARCH TO BE LIMITED, AND THE ABM TREATY MAKES NO ATTEMPT TO DO SO. IN A MAJOR STATEMENT BEFORE THE SOVIET PRESIDIUM IN 1972, SHORTLY AFTER THE ABM TREATY WAS SIGNED, THEN-SOVIET DEFENSE MINISTER GRECHKO STATED THAT THE ABM TREATY PROVIDES FOR A NUMERICALLY SMALL DEPLOYMENT OF SOVIET AND U.S. ABM SYSTEMS; IT ALSO PROHIBITS THE TRANSFER OF THESE SYSTEMS TO OTHER STATES AND THEIR DEPLOYMENT OUTSIDE NATIONAL TERRITORY. AT THE SAME TIME, IT "PLACES NO LIMITATIONS ON THE PERFORMANCE OF RESEARCH AND EXPERIMENTAL WORK AIMED AT RESOLVING THE PROBLEM OF DEFENDING THE COUNTRY AGAINST NUCLEAR MISSILE STRIKES."

THE UNITED STATES HAS TRADITIONALLY DISTINGUISHED "RESEARCH" FROM "DEVELOPMENT" ALONG THE LINES OUTLINED BY HAROLD BROWN IN A 1971 STATEMENT TO THE SOVIET SALT I DELEGATION. RESEARCH INCLUDES CONCEPTUAL DESIGN AND TESTING CONDUCTED BOTH INSIDE AND OUTSIDE THE LABORATORY. DEVELOPMENT FOLLOWS RESEARCH AND PRECEDES FULL-SCALE TESTING OF SYSTEMS AND COMPONENTS DESIGNED FOR ACTUAL DEPLOYMENT. THUS AS A PRACTICAL MATTER, DEVELOPMENT OF AN ABM WEAPON SYSTEM COMMENCES WITH THE FIELD TESTING OF ONE OR MORE PROTOTYPES OF THE ABM SYSTEM OR ITS COMPONENTS.

THE ABM TREATY DOES ADDRESS AND, IN CERTAIN ARTICLES, PLACES SPECIFIC LIMITS ON THE DEVELOPMENT AND TESTING OF CERTAIN ABM SYSTEMS AND COMPONENTS.

ARTICLE I PROHIBITS DEPLOYMENT OF ABM SYSTEMS FOR A TERRITORIAL DEFENSE OR FOR DEFENSE OF AN INDIVIDUAL REGION EXCEPT AS PROVIDED IN ARTICLE III. IT LIMITS DEPLOYMENT, NOT DEVELOPMENT OR TESTING, AND LIMITS ABM SYSTEMS, NOT ABM COMPONENTS.

ARTICLE II DEFINES AN ABM SYSTEM AS "A SYSTEM TO COUNTER STRATEGIC BALLISTIC MISSILES OR THEIR ELEMENTS IN FLIGHT TRAJECTORY." ACCORDING TO ARTICLE II (1), THE COMPONENTS OF AN ABM SYSTEM "CURRENTLY" CONSIST OF: ABM INTERCEPTOR MISSILES, WHICH ARE MISSILES CONSTRUCTED AND DEPLOYED FOR AN ABM ROLE OR OF A TYPE TESTED IN AN ABM MODE; ABM LAUNCHERS, WHICH LAUNCH ABM INTERCEPTOR MISSILES; AND ABM RADARS, WHICH ARE RADARS CONSTRUCTED AND DEPLOYED FOR AN ABM ROLE OR OF A TYPE TESTED IN AN ABM MODE.

ARTICLE III SPECIFIES THE AREAS IN WHICH ABM SYSTEMS OR THEIR COMPONENTS MAY BE DEPLOYED AND THE NUMBER THAT MAY BE DEPLOYED IN THOSE AREAS.

ARTICLE IV EXEMPTS FROM THE LIMITATIONS OF ARTICLE III SYSTEMS OR THEIR COMPONENTS USED FOR DEVELOPMENT OR TESTING AND LOCATED WITHIN AGREED TEST RANGES.

ARTICLE V PROHIBITS THE DEVELOPMENT, TESTING, AND DEPLOYMENT OF SEA-BASED, AIR-BASED, SPACE-BASED, OR MOBILE LAND-BASED ABM SYSTEMS AND ABM COMPONENTS.

ARTICLE VI PROHIBITS GIVING NON-ABM MISSILES, LAUNCHERS, OR RADARS AN ABM CAPABILITY OR TESTING THEM IN AN ABM MODE.

AGREED STATEMENT D, REINFORCING RESTRICTIONS ON DEPLOYMENT IN ARTICLE III, PROVIDES THAT, IF ABM SYSTEMS BASED ON "OTHER PHYSICAL PRINCIPLES" AND INCLUDING COMPONENTS CAPABLE OF SUBSTITUTING FOR ABM INTERCEPTOR MISSILES, ABM LAUNCHERS, OR ABM RADARS ARE CREATED IN THE FUTURE, LIMITATIONS ON SUCH SYSTEMS AND THEIR COMPONENTS WOULD BE SUBJECT TO DISCUSSION IN ACCORDANCE WITH ARTICLE XIII AND AGREEMENT IN ACCORDANCE WITH ARTICLE XIV.

PERMITTED DEVELOPMENT AND TESTING ACTIVITIES

TAKEN TOGETHER, THE PROVISIONS OF THE ABM TREATY PERMIT THREE TYPES OF SDI DEVELOPMENT AND TESTING ACTIVITIES.

CATEGORY 1 - CONCEPTUAL DESIGN OR LABORATORY TESTING. THIS ACTIVITY PRECEDES FIELD TESTING AND WAS CONSIDERED DURING THE ABM TREATY NEGOTIATIONS TO BE RESEARCH THAT WAS NOT VERIFIABLE BY NATIONAL TECHNICAL MEANS (NTM) AND NOT SUBJECT TO TREATY LIMITS.

CATEGORY 2 - "FIELD TESTING" OF DEVICES THAT ARE NOT ABM COMPONENTS, PROTOTYPES OF ABM COMPONENTS OR OTHERWISE CAPABLE OF SUBSTITUTING FOR ABM COMPONENTS. THE TREATY PERMITS THE TESTING OF DEVICES WHICH ARE (1) NOT ABM COMPONENTS OR CAPABLE OF SUBSTITUTING FOR AN ABM COMPONENT, AND (2) NOT TESTED IN AN ABM MODE. THESE TWO CRITERIA OF CAPABILITY AND TESTING ARE USED IN REVIEWING ALL CATEGORY 2 TESTS TO ENSURE THEY ARE CONSISTENT WITH ARTICLE V AND ARTICLE VI OBLIGATIONS. IT IS AN IMPORTANT PRINCIPLE THAT THE U.S. HAS LONG HELD THAT COMPLIANCE MUST BE BASED ON OBJECTIVE ASSESSMENTS OF CAPABILITIES AND NOT SUBJECTIVE JUDGMENTS AS TO INTENT.

AS NOTED EARLIER, ARTICLE V PROHIBITS THE DEVELOPMENT, TESTING, AND DEPLOYMENT OF ABM SYSTEMS OR COMPONENTS WHICH ARE

SEA-BASED, AIR-BASED, SPACE-BASED, OR MOBILE LAND-BASED. THE NEGOTIATING RECORD OF THE ABM TREATY SHOWS IT WAS CLEARLY UNDERSTOOD IN 1972 THAT "DEVELOPMENT" BEGINS WHEN FIELD TESTING IS INITIATED ON A PROTOTYPE OF AN ABM COMPONENT. THE DEFINITION OF "DEVELOPMENT" APPLIED TO THE ARTICLE V LIMITATIONS RESULTS IN THE PROHIBITION OF FIELD TESTING OF ABM SYSTEMS OR COMPONENTS, OR THEIR PROTOTYPES WHICH ARE OTHER THAN FIXED LAND-BASED. THUS, SDI FIELD TESTS OF SPACE-BASED OR OTHER MOBILE-BASED DEVICES CANNOT INVOLVE ABM COMPONENTS OR PROTOTYPES (OR ABM SYSTEMS OR THEIR PROTOTYPES). ALL SDI CATEGORY 2 EXPERIMENTS MUST MEET THIS CRITERION.

NO ABM COMPONENT OTHER THAN A FIXED LAND-BASED COMPONENT MAY BE "TESTED IN AN ABM MODE." THE TERM "TESTED IN AN ABM MODE" IS SPECIFICALLY ADDRESSED IN A CLASSIFIED AGREED STATEMENT NEGOTIATED IN 1978 BY THE U.S. AND USSR IN THE STANDING CONSULTATIVE COMMISSION (SCC).

THAT AGREEMENT PROVIDES IN PART, THAT AN ABM INTERCEPTOR MISSILE IS CONSIDERED TO BE "TESTED IN AN ABM MODE" IF, WHILE GUIDED BY AN ABM RADAR, IT HAS BEEN LAUNCHED FROM AN ABM LAUNCHER OR HAS ATTEMPTED TO INTERCEPT (SUCCESSFULLY OR NOT) A STRATEGIC BALLISTIC MISSILE OR ITS ELEMENTS IN FLIGHT TRAJECTORY. IF AN ABM INTERCEPTOR IS GIVEN THE CAPABILITY TO CARRY OUT AN INTERCEPTION WITHOUT BEING GUIDED BY AN ABM RADAR, THEN THE TERM "TESTED IN AN ABM MODE" IS SUBJECT TO DISCUSSIONS AND AGREEMENT IN THE SCC. LIKEWISE AN ABM RADAR IS CONSIDERED TO BE "TESTED IN AN ABM MODE" IF IT PERFORMS CERTAIN FUNCTIONS SUCH AS TRACKING AND GUIDING AN ABM INTERCEPTOR MISSILE OR TRACKING STRATEGIC BALLISTIC MISSILES OR THEIR ELEMENTS IN FLIGHT TRAJECTORY IN CONJUNCTION WITH AN ABM RADAR WHICH IS TRACKING AND GUIDING AN ABM INTERCEPTOR MISSILE. THE PHRASE "STRATEGIC BALLISTIC MISSILES OR THEIR ELEMENTS IN FLIGHT

TRAJECTORY" INCLUDE BALLISTIC TARGET-MISSILES WITH THE FLIGHT TRAJECTORY CHARACTERISTICS OF STRATEGIC BALLISTIC MISSILES OR THEIR ELEMENTS OVER THE PORTIONS OF THE FLIGHT TRAJECTORY INVOLVED IN TESTING. TRACKING ALONE IS INSUFFICIENT FOR A RADAR TO BE TESTED IN AN ABM MODE; THE PRESENCE OF AN ABM INTERCEPTOR BEING GUIDED BY AN ABM RADAR IS ALSO REQUIRED.

SDI DEVICES WHICH ARE NOT ABM RADARS OR ABM INTERCEPTORS HAVE BEEN REVIEWED FOR WHETHER THEY WILL BE "TESTED IN AN ABM MODE" BY ANALOGY TO THE 1978 AGREED STATEMENT WHICH ONLY ADDRESSES TRADITIONAL COMPONENTS.

IN PRACTICE, NEITHER THE UNITED STATES NOR THE SOVIET UNION CONSIDERS SUCH "FLIGHT TRAJECTORY" TO INCLUDE AN ORBIT IN SPACE OR "TESTED IN AN ABM MODE" TO ENCOMPASS TESTS AGAINST TARGETS IN SPACE THAT DO NOT FOLLOW A BALLISTIC MISSILE FLIGHT TRAJECTORY. THE SOVIET UNION CONDUCTED TESTS AGAINST OBJECTS IN EARTH ORBIT IN THE 1970S BOTH PRIOR TO AND AFTER DEPLOYING THEIR ANTISATELLITE WEAPON. BASED BOTH ON THIS UNDERSTANDING OF "TESTED IN AN ABM MODE" AND ON THE FACT THAT COMPONENTS, AS DEFINED IN ARTICLE II, WERE NOT INVOLVED, THE UNITED STATES RECENTLY CONDUCTED THE DELTA 180 SDI [STRATEGIC DEFENSE INITIATIVE] EXPERIMENT. SINCE NO DEVICE IN THE EXPERIMENT WAS TESTED IN AN ABM MODE AND NO DEVICE IN THE EXPERIMENT COULD SUBSTITUTE FOR AN ABM COMPONENT, NONE OF THE DEVICES IN THIS EXPERIMENT WAS ITSELF AN ABM COMPONENT; THE EXPERIMENT, THEREFORE, WAS FULLY CONSISTENT WITH THE ABM TREATY.

CATEGORY 3 - "FIELD TESTING" OF FIXED LAND-BASED ABM COMPONENTS. "FIELD TESTING" OF FIXED LAND-BASED ABM COMPONENTS OR SYSTEMS IS PERMITTED AS LONG AS OTHER TREATY PROVISIONS ARE MET. UNDER ARTICLE IV ALL SUCH TESTS MUST TAKE PLACE AT AGREED ABM TEST RANGES (FOR THE U.S., WHITE SANDS MISSILE RANGE AND

KWAJALEIN MISSILE RANGE), AND THE TOTAL TEST LAUNCHER COUNT MUST NOT EXCEED 15.

SUCH TESTING MUST COMPLY WITH LIMITATIONS IN PARAGRAPH 2 OF ARTICLE V ON LAUNCHER CAPABILITIES AS FOLLOWS:

> EACH PARTY UNDERTAKES NOT TO DEVELOP, TEST, OR DEPLOY ABM LAUNCHERS FOR LAUNCHING MORE THAN ONE ABM INTERCEPTOR MISSILE AT A TIME FROM EACH LAUNCHER, NOR TO MODIFY DEPLOYED LAUNCHERS TO PROVIDE THEM WITH SUCH A CAPABILITY, NOR TO DEVELOP, TEST, OR DEPLOY AUTOMATIC OR SEMI-AUTOMATIC OR OTHER SIMILAR SYSTEMS OF RAPID RELOAD OF ABM LAUNCHERS.

COMPLIANCE ASSESSMENT

THE ENTIRE SDI RESEARCH PROGRAM IS BEING CONDUCTED IN COMPLIANCE WITH THE ABM TREATY. SDI CURRENTLY PLANS TO CONDUCT ABOUT NINE MAJOR EXPERIMENTS BETWEEN NOW AND THE END OF THE FY 1989. TWO OF THE EXPERIMENTS FALL INTO CATEGORY 1. THEY ARE COMPLIANT BECAUSE THEY ARE LABORATORY TESTS CONDUCTED UNDER ROOF. THESE TESTS HAVE NOT REACHED THE STAGE OF "FIELD TESTING" AT WHICH THE ABM TREATY PROVISIONS ARE APPLICABLE. THE FIRST OF THESE TESTS IS ALPHA, A GROUND-BASED LASER DEVICE DESIGNED TO DEMONSTRATE THE FEASIBILITY OF HIGH POWER INFRARED (IR) CHEMICAL LASERS FOR SPACE-BASED APPLICATIONS. ASSOCIATED WITH ALPHA IS THE LARGE OPTICS DEMONSTRATION EXPERIMENTS (LODE) AND LARGE ADVANCED MIRROR PROGRAM (LAMP). THEY ARE TO DEMONSTRATE CRITICAL BEAM CONTROL AND LARGE LIGHTWEIGHT SPACE OPTICS TECHNOLOGIES RESPECTIVELY, IN A SERIES OF GROUND-BASED EXPERIMENTS SIMULATING THE SPACE ENVIRONMENT. THE SECOND CATEGORY 1 EXPERIMENT IS THE GROUND-BASED HYPERVELOCITY RAILGUN (GBHRG) RESEARCH WHICH IS INTENDED TO VALIDATE THE WEAPON

POTENTIAL OF A HYPERVELOCITY GUN AND ASSOCIATED MINIATURE KILL VEHICLE TECHNOLOGY. THE TEST WILL DEMONSTRATE THE CAPABILITY TO LAUNCH UNGUIDED AND GUIDED PROJECTILES AT HYPERVELOCITIES FROM GROUND-BASED RAIL GUNS WITHIN A LABORATORY ENVIRONMENT.

THE REMAINING SEVEN EXPERIMENTS ARE CATEGORY 2 TESTS. EACH HAS BEEN CAREFULLY REVIEWED TO ENSURE THAT IT WILL NOT INVOLVE TESTING IN AN ABM MODE, OR INVOLVE ANY DEVICE THAT POSSESSES ABM CAPABILITIES. SINCE THE DETAILED CHARACTERISTICS OF THE TEST DEVICES ARE CLASSIFIED, IT IS NOT POSSIBLE IN AN UNCLASSIFIED TESTIMONY TO GO INTO DETAIL.

TWO OF THE CATEGORY 2 TESTS ARE FIXED LAND-BASED AND LOCATED AT AN ABM TEST RANGE (WHITE SANDS). HOWEVER, WE DO NOT CONSIDER THEM ABM COMPONENT TESTS BECAUSE THEY LACK ABM CAPABILITY AND WILL NOT BE TESTED IN AN ABM MODE. THE FIRST IS THE FLEXIBLE LIGHTWEIGHT AGILE GUIDED EXPERIMENT (FLAGE). IT IS A RESEARCH PROGRAM TO EXPLORE SMALL NON-NUCLEAR, HIT-TO-KILL TECHNOLOGY FOR A SHORT RANGE, LOW ALTITUDE INTERCEPTOR. IT IS NOT ABM CAPABLE AND WILL ONLY BE TESTED AGAINST TACTICAL, SHORT RANGE MISSILES. THE SECOND, THE SKYLITE PROGRAM, INVOLVES THE MIRACL LASER AT THE WHITE SANDS MISSILE RANGE WHICH HAS NEITHER THE POWER NOR THE OPTICS FOR ATMOSPHERIC PROPAGATION AT RANGES USEFUL FOR ABM APPLICATION.

ANOTHER TEST INVOLVES AN EXPERIMENTAL DEVICE DESIGNED TO TEST THE FEASIBILITY OF LONG WAVELENGTH INFRARED (LWIR) ACQUISITION AND TRACKING FROM AN AIRBORNE PLATFORM. THE AIRBORNE OPTICAL ADJUNCT (AOA) EXPERIMENTAL DEVICE LACKS THE CAPABILITY OF BEING A SUBSTITUTE FOR AN ABM COMPONENT AND WILL NOT BE TESTED IN AN ABM MODE.

THE SATKA INTEGRATED EXPERIMENT (SIE) WILL INVESTIGATE TECHNOLOGIES IN NETTING TOGETHER EXISTING SURVEILLANCE AND RANGE

SENSORS ON VARIOUS PLATFORMS TO ACCOMPLISH END-TO-END TRACKING OF STRATEGIC BALLISTIC MISSILES. NONE OF THE SENSORS INVOLVED IN THE SIE PROJECT ARE ABM COMPONENTS NOR WILL THEY BE TESTED IN THE ABM MODE.

DELTA 181 AND JANUS ARE BOTH EXPERIMENTS TO GATHER SIGNATURE DATA ON OBJECTS AT CLOSE RANGE. THEY DO NOT INVOLVE INTERCEPTS OR ABM CAPABLE COMPONENTS. NEITHER WILL INVOLVE A TEST IN AN ABM MODE.

THE SPACE TRACKING AND POINTING EXPERIMENT (TPE) PROGRAM WILL CONCENTRATE ON TECHNOLOGIES REQUIRED FOR TRACKING, AND POINTING OF WEAPONS AND SENSORS FOR SPACE- AND GROUND-BASED APPLICATIONS. CURRENT PLANS CALL FOR A SHUTTLE AND FREE FLYER EXPERIMENTS OVER THE NEXT FEW YEARS. THESE DEVICES WILL ALSO NOT BE CAPABLE OF SUBSTITUTING FOR ABM COMPONENTS AND WILL NOT BE TESTED IN AN ABM MODE.

Senator EXON. Mr. Secretary, thank you very much. We will move right into our questioning.

Senator Levin has been very much involved in the treaty interpretations on this matter, and I think there may be several questions to you on this subject. So I will now recognize Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

Welcome, Mr. Godwin and our other witnesses.

ABM TREATY

Can you tell me who was responsible for this treaty monitoring function before you came, before your position was created?

Mr. GODWIN. It was Donald Hicks. He was the Director of Defense for Research and Engineering.

Senator LEVIN. Do you know what the instructions were relative to the interpretation of the ABM Treaty prior to the creation of your office?

Mr. GODWIN. I believe that the interpretation was the restrictive interpretation, the same as we are operating under now.

Senator LEVIN. Would you be able to go back into your predecessor's files to determine that and provide for the record what those instructions were—anything which relates to the question of the narrow versus broad interpretation?

Mr. GODWIN. I would be glad to do that, yes.

Senator LEVIN. Your predecessor would not have used those words. The issue would have been the language which was in use at that time.

Mr. GODWIN. Yes.

Senator LEVIN. Thank you.

[The information follows:]

DODI 5100.72, "Procedures for the Implementation of Strategic Arms Limitations (SAL) Agreements and Measures Agreements" dated May 31, 1977, is the implementing instruction for assuring continued compliance with all U.S.-Soviet Strategic Arms Limitation and Measures Agreements presently in force. It provides a general framework of guidelines within which the compliance program for DOD will operate. The question of "Other Physical Principles" and the services and SDIOs responsibilities regarding OPP are included in this instruction. The procedures in DODI 5100.72 were in effect when I assumed my current responsibilities and have only been modified by the President's decision to no longer abide by the provisions of the SALT treaties. This regulation, classified SECRET, is included in its entirety as an attachment to this insert.

DEPARTMENT OF DEFENSE INSTRUCTION

Subject: Procedures for the Implementation of Strategic Arms Limitation (SAL) Agreements and Measures Agreements (U).

Reference(s): (a) DOD Instruction S-5100.72, subject as above, May 8, 1973 (hereby cancelled).

(b) Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitations of Anti-Ballistic Missile Systems, May 26, 1972, including Agreed Interpretations, Common Understandings, and Unilateral Statements (TIAS* 7503).[1]

(c) Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms, May 26, 1972, including Agreed Interpretations, Common Understandings, and Unilateral Statements (TIAS 7504).[1]

(d) Protocol to the Interim Agreement Between the United States of America and the Union of Soviet Socialist Republics on Certain Measures with Respect to the Limitation of Strategic Offensive Arms, May 26, 1972 (TIAS 7504).[1]

(e) through (k), see enclosure 2.

A. REISSUANCE AND PURPOSE

This Instruction reissues reference (a) to set forth the procedures for assuring continuing DOD compliance with U.S.—Soviet Strategic Arms Limitation and Measures Agreements presently in force (references (b), (c), (d), (e), (f), (g), (h), (i) and (j)). It further provides a general framework of guidelines within which the compliance program will operate. Reference (a) is hereby superseded and cancelled.

B. APPLICABILITY AND SCOPE

The provisions of this Instruction apply to the Office of the Secretary of Defense, the Military Departments, the Organization of the Joint Chiefs of Staff, and the Defense Agencies. It is intended to provide implementing instructions derived from the SAL Agreements concerning the testing, construction, development and deployment of certain strategic weapons and supporting equipment, under the aegis of the Department of Defense, and the Measures Agreements to reduce the risk of nuclear war.

C. DEFINITIONS

1. SAL Agreements, for the purpose of this Instruction are the Strategic Arms Limitation Agreements between the United States and the Soviet Union, and include the ABM Treaty, the Interim Agreement on Strategic Offensive Arms, the Protocol to the ABM Treaty, the Protocol to the Interim Agreement, and the Agreed

*TIAS: Treaty and International Agreement Series.

[1] Agreements are filed with the General Counsel, DOD pursuant to DOD Instruction 5530.3, November 3, 1976.

Interpretations (see references (b), (c), (d), (e), (f), (g), and (h), and section B. of enclosure 1).

2. These Agreements are accompanied by U.S. Unilateral Statements which were made during the negotiations and were intended to record the U.S. position on issues where no definitive agreement was reached. Therefore, the requirement to comply with these Unilateral Statements shall be determined, as required, by DDR&E.

3. Measures Agreements, for the purpose of this Instruction, are: the Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics, and the Protocol on the Use of Immediate Notifications in Implementing the Agreement on Measures (references (i) and (j)).

D. RESPONSIBILITIES AND PROCEDURES

1. Pursuant to DOD Directive 5100.70 (reference (k)), the Director, Defense Research and Engineering (DDR&E) has been assigned the primary responsibility for assuring compliance with the SAL Agreements and Measures Agreements.

2. Each Military Department, the Organization of the Joint Chiefs of Staff, the Defense Advanced Research Projects Agency, and the National Security Agency shall submit to the DDR&E a quarterly comprehensive report of compliance with SAL Agreements, Measures Agreements, and guidelines provided in enclosure 1. In addition, each report will provide pertinent information covering current projects and future actions to insure continuing compliance with the SAL Agreements, Measures Agreements, and guidelines. The report shall be submitted within 30 days of the end of each calendar quarter. Report Control Symbol DD–DR&E(Q) 1299 is assigned to this series of reports.

3. The DDR&E may request Special Reports to provide more detailed information on any topic covered in the Quarterly Report, or to answer specific questions which may arise in connection with DOD compliance with the Agreements.

4. Questions of interpretation of the above Agreements will be referred to the DDR&E to be resolved on a case-by-case basis. No project or program which reasonably raises an issue as to compliance with the SAL Agreements shall enter into the testing, prototype construction, or deployment phases without prior clearance from the DDR&E. If such a compliance issue is in doubt, DDR&E approval shall be sought. In conjunction with the General Counsel, Department of Defense, the DDR&E will apply the provisions of the SAL Agreements and other supplementary instruments, as appropriate.

5. The DDR&E will submit timely reports to the Secretary of Defense concerning the compliance program, including recommendations on issues which may be raised in the National Security Council (NSC) and Standing Consultative Commission (SCC).

6. The DDR&E will maintain a central file of the pertinent correspondence, analyses, and supporting materials. When required, the DDR&E will prepare and collect such material for the Secretary of Defense for his use at meetings of the NSC, and for the Deputy Secretary of Defense for his use at meetings of the NSC.

7. The Military Departments, the Organization of the Joint Chiefs of Staff, the Defense Advanced Research Projects Agency, and the National Security Agency shall designate an office or individual who will monitor his Department or Agency to insure that it is in compliance with the SAL Agreements and Measures Agreements.

8. As provided for in DOD Directive 5100.70 (reference (k)), the DDR&E may conduct or request an inspection of field and laboratory facilities to insure compliance with the provisions of this Instruction. The Secretary of any Military Department may be called upon to provide Inspector General assistance with such investigations.

E. EFFECTIVE DATE

This Instruction is effective immediately. Forward two copies of implementing documents to the Director, Defense Research and Engineering, within 60 days.

WILLIAM J. PERRY,
Director of Defense Research and Engineering.

Restrictions Resulting From the SAL and Measures Agreements Which Require DOD Compliance (U)

A. (U) CONSTRAINTS

(U) The SAL and Measures Agreements have imposed certain constraints and undertakings upon the United States Government. These can be divided into four major categories: (1) Those affecting defensive weapons systems; (2) those affecting offensive weapons systems; (3) certain general limitations and (4) notification requirements established in the Measures Agreements. The specific restrictions will be defined separately below (in sections B.–F.)

B. (S) DEFINITIONS

(S) To provide consistency in implementation, the following definitions apply (U):

1. (S) ABM System—For the purpose of this Instruction, an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory. [Deleted.]
2. (U) ABM interceptor missile—A missile which has been constructed and deployed for an ABM role, or of a type which has been tested in an ABM mode.
3. (U) ABM launcher—A launcher constructed and deployed for launching ABM interceptor missiles, or of a type tested in an ABM mode.
4. (U) ABM radar—A radar constructed and deployed for an ABM role, or of a type tested in an ABM mode.
5. (U) ABM system components currently consist of any or all of the following: ABM interceptor missiles, ABM launchers, and ABM radars, including those which are operational, under construction, undergoing test, undergoing overhaul, repair or conversion.
6. (U) Deployment—Transfer of equipment to control of field units in an operationally usable condition.
7. (C) Development—All activities following the [deleted].
8. (U) Early Warning—Early notification of the launch or approach of unknown weapons or weapon carriers.
9. (U) ICBM—A land-based ballistic missile capable of a range in excess of 5,500 km.
10. (U) Modern submarine-launched ballistic missiles. Ballistic missiles installed in any nuclear-powered submarines or submarine-launched ballistic missiles, first flight tested since January 1, 1965 and installed in any submarine, regardless of type.
11. (U) Testing—Verification of prototype, or breadboard model performance, or training under field conditions. (This term does not apply to laboratory experiments.)

C. (S) RESTRICTIONS ON UNITED STATES DEFENSIVE WEAPON SYSTEMS (U)

1. (U) Operational ABM systems and components thereof may be deployed at only one area. The area currently authorized is the ICBM silo launcher complex near Grand Forks, N. Dak.
2. (U) The ABM system deployment area shall be limited to no more than 100 ABM launchers and no more than 100 interceptor missiles at launch sites.[1] All equipment at each deployment area shall be located within a circle of 150 Km radius. The center of the circle at Grand Forks may be any point within the ICBM complex.
3. (U) No more than 20 ABM radars shall be deployed in the ABM deployment area at Grand Forks.[1] Two of these ABM radars may be the Missile Site Radar (MSR) and the Perimeter Acquisition Radar (PAR), or similar large, phased-array-type radars, comparable in potential (the product of mean emitted power in watts and antenna area in square meters). Each of the remaining 18 radars shall have a potential of less than 3 million Wm^2.
4. (U) There shall be no development, testing or deployment of ABM systems or components which are air based, sea based, space based or mobile land based.
5. (U) There shall be no development, testing or deployment of ABM launchers for launching more than one ABM interceptor missile at a time from each launcher; or modification to deployed launchers to provide them with such a capability; or devel-

[1] The numerical limitations at the area include any deployed training ABM system components capable of operational use.

opment, testing or deployment of automatic or semiautomatic or other similar systems for rapid reload of ABM launchers.

6. (U) There shall be no development, testing or deployment of any ABM interceptor missile equipped with more than one independently guided warhead.

7. (C) DDR&E shall be notified if and when systems or components [deleted].

8. (U) All ABM system component R&D testing shall take place only at approved sites. At present, these are located at White Sands Missile Range and Kwajalein Missile Range. (Verification and performance testing may also be conducted at the Grand Forks, N. Dak. site.) Range safety and instrumentation radars may be located outside test sites.

9. (U) ABM systems or their components shall not be deployed outside U.S. national territory.

10. (U) Missiles, launchers, and radars, other than ABM interceptor missiles, ABM launchers, and ABM radars, shall not be given capabilities to counter strategic ballistic missiles or their elements in flight trajectory. Non-ABM missiles, non-ABM launchers, and non-ABM radars (including range safety and instrumentation radar and especially SAM radars) shall not be tested in an ABM mode. [Deleted.] All such test plans shall require prior approval of DDR&E. Any of the following events would constitute testing in an ABM mode.

a. (U) A launcher is used to launch an ABM interceptor missile;

b. (U) An interceptor missile is flight tested against a target vehicle which has a flight trajectory with characteristics of a strategic ballistic missile flight trajectory, or is flight tested in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range, or is flight tested to an altitude inconsistent with interception of targets against which air defenses are employed; or

c. (U) A radar makes measurements on a cooperative target vehicle of the kind referred to in b., above, during the reentry portion of its trajectory or makes measurements in conjunction with the test of an ABM interceptor missile or an ABM radar at the same test range.

11. (U) Future radars for early warning of strategic ballistic missile attack shall be deployed along the periphery of national territory and oriented outward. Specific siting decisions, as they relate to the SAL Agreements, will be made on a case-by-case basis by the DDR&E.

12. (U) ABM systems and components limited by the ABM Treaty shall not be transferred to any foreign state. Technical descriptions and blueprints, specially worked out for the construction of those ABM systems and components limited by the ABM Treaty, shall not be provided to any foreign state.

13. (U) No more than a total of 15 ABM launchers are permitted at currently specified test ranges (see section C.8., above).

14. (U) Procedures for the replacement, dismantling and destruction of excess ABM test launchers at ABM test ranges were formulated in the document, Protocol on Procedures Governing Replacement, Dismantling or Destruction, and Notification Thereof, for ABM Systems and Their Components of July 3, 1974 (reference (f)). Implementing instructions for this Protocol were forwarded to the appropriate DOD activities by DDR&E memorandum of August 13, 1974, "Dismantling of ABM Systems and Their Components." A Supplementary Protocol to the above Protocol was signed by both nations on October 28, 1976 (reference (g)) and governs replacement or destruction of ABM systems or components and exchange of ABM deployment areas. Implementing instructions for this Supplementary Protocol were issued by DDR&E memorandum of January 13, 1977.

15. (U) There shall be no deliberate concealment measures which impede verification by national technical means of compliance with the provisions of the ABM Treaty. This obligation shall not require changes in current construction, assembly, conversion, or overhaul practices. Deviation from current practices shall be referred to DDR&E for approval.

16. (U) The Military Departments, the Organization of the Joint Chiefs of Staff, and the Defense Agencies shall not enter into any international obligations which conflict with the ABM Treaty.

D. (S) RESTRICTIONS ON UNITED STATES STRATEGIC OFF-SITE WEAPON SYSTEMS (U)

1. (C) Construction of additional fixed operational ICBM launchers shall not be started. Furthermore, the total number of deployed ICBM launchers—other than test and training launchers—shall not exceed 1,054, [deleted] must have prior DDR&E approval.)

2. (U) The number of SLBM launchers shall be limited to 656, unless some or all of the older ICBM launchers (Titan II) are replaced by SLBM launchers. Then the

total number of SLBM launchers may go as high as 710. The total number of modern ballistic missile submarines shall not exceed 44.

3. (U) Replacement, dismantling or destruction of strategic offensive arms will be performed in accordance with provisions contained in the "Protocol on Procedures Governing Replacement, Dismantling or Destruction, and Notification Thereof, for Strategic Offensive Arms" (reference (h)). Implementing instructions for this Protocol were forwarded to the appropriate DOD agencies by DDR&E memorandum of August 13, 1974, "Dismantling of Strategic Offensive Arms."

4. (S) [Deleted] without prior approval of DDR&E.

5. (S) [Deleted] be referred to DDR&E for approval.

E. (S) GENERAL LIMITATIONS (U)

1. (S) The United States is committed not to interfere with the national technical means of verification of the Soviet Union as long as the Soviet Union is using those means in accordance with the provisions of the ABM Treaty and Interim Agreement, and in a manner consistent with generally recognized principles of international law. Consequently, [deleted] shall be submitted to DDR&E for its prior review, pursuant to the procedures set forth in D.4., basic Instruction.

2. (S) No phased-array radars may be deployed having a potential exceeding 3 million Wm^2, except at the permitted ABM site, and except for purposes of tracking objects in outer space or for use as national means of verification. ("Potential" is defined in C.3., above.) Any plans for [deleted] shall be submitted to DDR&E for approval.

F. (U) CERTIFICATION OF COMPLIANCE WITH THE MEASURES AGREEMENTS AND THE IMMEDIATE NOTIFICATIONS PROTOCOL (U)

(U) The Military Departments are required, under the provisions of JCS publication VI "Joint Reporting Structure," to report events falling within the purview of the Measures Agreement (reference (i)) and the Immediate Notifications Protocol (reference (j)). The Military Departments and the Organization of the Joint Chiefs of Staff shall notify DDR&E, in the quarterly compliance report, of DOD compliance with the provisions of the Measures Agreements.

(e) Protocol to the Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems, July 3, 1974 (TIAS 8276) [1]

(f) Protocol on Procedures Governing Replacement, Dismantling or Destruction, and Notification Thereof for ABM Systems and Their Components, July 3, 1974

(g) A Supplementary Protocol to the Protocol on Procedures, Governing Replacement, Dismantling or Destruction, and Notification Thereof, for ABM Systems and Their Components, October 28, 1976

(h) Protocol on Procedures Governing Replacement, Dismantling or Destruction, and Notification Thereof, for Strategic Offensive Arms, July 3, 1974

(i) Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics, dated September 30, 1971 (TIAS 7186) [1]

(j) Protocol on the Use of Immediate Notification in Implementation of the Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War Between the United States of America and the Union of Soviet Socialist Republics of September 30, 1971, dated September 30, 1976

(k) DOD Directive 5100.70, "Implementation of SAL Agreements," January 9, 1973

Senator LEVIN. Can you tell us whether or not there is any planned experiment now through 1992 which is not consistent with the narrow interpretation of the treaty?

Mr. GODWIN. I cannot speak through 1992, but I might ask others to do that. Through 1989, to my knowledge there are no planned experiments which would not conform to the ABM Treaty under the restrictive interpretation.

Senator LEVIN. Have you reviewed the experiments that are assumed in the budget request which has been filed with us? Have you looked at all those tests?

Mr. GODWIN. Sir, I have not personally. Mr. Lee Minichiello, on my right, has, and much of the information that I passed on to you was generated by the Compliance Review Group.

Senator LEVIN. My question to you is has your office reviewed the budget submission of the President to the Congress?

Mr. GODWIN. We review them on a case-by-case basis. I don't know if we have done them all.

Senator LEVIN. Does the budget submission set forth in some background materials or in the submission itself what experiments and tests would be funded in that budget?

Mr. GODWIN. May I ask the General to respond to that? I am not familiar with the relationship of the tests to the budget. I believe they are all included, but I think he has a better feel for this than I do.

General ABRAHAMSON. Sir, the budget is reviewed in several ways within the Department of Defense.

First of all, the Defense Review Board looks at the overall budget and the overall budget levels. In many cases, this is examined down into some depth, but not to the level of every particular experiment.

We have what we call an Oversight Committee, which is chaired by Mr. Taft, and it includes the secretaries of all the departments. It includes Mr. Godwin and his predecessor and many of our key OSD policy personnel and others, such as Mr. Helms, who are critical in that overall process.

They review the general course of the program.

In some cases, where there is a questionable kind of experiment, one that does cause concern on our part or on anyone's part is briefed in detail. An example of that was the Delta 180 experiment. That particular experiment was one that had to be carefully examined, not because it was in any way a violation of the treaty, but because there was the potential for a perception that could be incorrectly looked at.

That was briefed not only in the Department of Defense but through the Department of State and all the way to the President, and it was briefed in the Congress very carefully.

Senator LEVIN. But that is not my question.

I am trying to get to Mr. Godwin's role.

You are responsible for making sure that any experiment complies with the ABM Treaty. You have been under guidance that the ABM Treaty interpretation, as of this point, continues to be the narrow or restrictive view. My question is have you looked at each of the experiments in this budget submission, or has your office looked at this budget submission to be sure that everything in that budget submission, assumed by it and funded by it, complies with the narrow interpretation? That is my question.

Mr. GODWIN. The answer is yes. All of the experiments now planned conform to the narrow interpretation or the restrictive interpretation.

Senator LEVIN. And your office has reviewed that?

Mr. GODWIN. Yes.

Senator LEVIN. Now, if there were a broad interpretation adopted by the administration, you would be given that guidance, I presume, is that correct?

Mr. GODWIN. Yes.

Senator LEVIN. You would be bound by it.

Mr. GODWIN. Yes.

Senator LEVIN. Do you know if there would be a budget amendment sought if there were a broad interpretation? Since the current budget assumes in its experiments the narrow interpretation, if there were a broad interpretation adopted by the administration, would there not necessarily be a budget amendment sought, either upping or downing the budget?

Mr. GODWIN. I am not familiar with the detailed answer to that question. In general, the answer is that certain types of activities would be permitted which might allow the program to go more rapidly; therefore, there could possibly be a budget amendment sought. I do not know if there would be, though.

Senator LEVIN. Has your office rendered any written opinions or any written statement relative to the experiments in this budget request certifying their compliance with the narrow interpretation of the ABM Treaty?

Mr. GODWIN. Yes.

Senator LEVIN. Would you submit those for the record?

Mr. GODWIN. I will.

Senator LEVIN. Thank you.

[The information follows:]

The Strategic Defense Initiative (SDI) major experiments are reviewed annually for compliance in accordance with Section 1102 of the Department of Defense Authorization Act, fiscal year 1985. In this overall Report to Congress on the SDI, compliance is treated as a separate appendix. The unclassified version of Appendix D of the 1987 Report to the Congress (the most recent version) is attached as the authoritative statement discussing compliance of each major experiment with the "Narrow" interpretation of the ABM Treaty.

APPENDIX D
COMPLIANCE OF THE STRATEGIC DEFENSE INITIATIVE WITH THE ABM TREATY

INTRODUCTION AND SCOPE

This appendix addresses compliance with the ABM Treaty of activities under the Strategic Defense Initiative (SDI) and related programs. The treatment of devices based on "other physical principles" is discussed. The existing process for ensuring compliance with Strategic Arms Limitation (SAL) Agreements, including organizational responsibilities and reporting procedures and their application to SDI and the ABM Treaty, is also described.

POLICY

There are four major points to be made regarding United States policy on compliance with the ABM Treaty.

First, the SDI research program is being conducted in a manner fully consistent with all U.S. treaty obligations. The President has directed that the Program be formulated in a fully compliant manner, and the DoD has planned and reviewed the program (and will continue to do so) to ensure that it remains compliant.

Second, the President directed that as a matter of policy the SDI Program be conducted according to a more restrictive interpretation of the ABM Treaty than the United States could justifiably observe. Under the broader interpretation of the Treaty, ABM systems that are "based on other physical principles" (i.e., other than ABM interceptor missiles, ABM launchers, and ABM radars) and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars may be developed and tested but not deployed, regardless of their basing mode. Under the more restrictive interpretation, development and testing of ABM systems based on other physical principles are allowed only for fixed land-based systems and components.

Since the President has decided as a matter of policy to observe the more restrictive interpretation of the ABM Treaty, all statements in this appendix regarding compliance with

treaty provisions should be understood to be based on the more restrictive interpretation. The President has reserved the right to restructure the SDI Program to take full advantage of the broader bounds of the ABM Treaty.

Third, because there are areas which are not fully defined in the ABM Treaty*, it is necessary in some cases to infer specific standards for compliance. Three of the more important working principles of this review used to establish such standards are that:

- Compliance must be based on objective assessments of capabilities which support a single standard for both sides and not on subjective judgments as to intent which could lead to a double standard of compliance.

- The ABM Treaty in Article V prohibits the development, testing, and deployment of ABM systems and components that are sea-based, space-based, air-based, or mobile land-based. However, the Treaty does not limit research and its associated testing short of field testing of a prototype ABM system or component.

- The ABM Treaty, of course, restricts only defenses against strategic ballistic missiles; it does not apply to defenses against cruise missiles or defenses against nonstrategic ballistic missiles, provided that such defenses do not have an ABM capability.

Fourth, the United States government must guard against permitting a double standard of compliance, under which the Soviet government could expect to violate particular provisions

*An example of such an area within the restrictive interpretation of the Treaty is the subject of components. ABM components are defined in the Treaty as "currently" (i.e., 1972) consisting of ABM missiles, launchers, and radars. But there is no agreed definition of what constitutes an "ABM component" based on other physical principles, beyond the guidance in Agreed Statement D: "In order to ensure fulfillment of the obligation not to deploy ABM systems and their components except as provided in Article III of the Treaty, the Parties agree that in the event ABM systems based on other physical principles and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars are created in the future [i.e., after 1972], specific limitations on such systems and their components would be subject to discussion in accordance with Article XIII and agreement in accordance with Article XIV of the Treaty."

of arms agreements without consequence, while the U.S. continues to comply with all provisions. We have not considered Soviet violation of the ABM Treaty in this report. The United States has reserved the right to respond to that violation in appropriate ways, some of which may eventually bear on the Treaty constraints as they apply to the United States.

OVERALL COMPLIANCE ASSESSMENT

The entire SDI Program is being conducted in compliance with the ABM Treaty and all other U.S. treaty obligations. The SDI Program consists of near-term technology research projects and major experiments. The research projects directly support the major experiments by providing the necessary technologies. These activities are well defined and clearly compliant. The major experiments, most of which are to be conducted in later years, are also being planned to be fully compliant. Experiments can demonstrate technical feasibility without involving ABM systems or components or devices with their capabilities. Thus, useful and compliant experiments, in both "mobile" and "fixed land-based" configurations, are allowed.

EXISTING COMPLIANCE PROCESS FOR SDI

DoD has in place an effective compliance process (established in 1972 after the signing of the SALT I agreements), under which key offices in DoD are responsible for overseeing and will continue to oversee SDI compliance with all U.S. arms control commitments. Under this process the SDI Organization (SDIO) and Services ensure that the implementing program offices adhere to DoD Compliance Directives and seek guidance from offices charged with oversight responsibility.

Specific responsibilities are assigned by DoD Directive 5100.70, 9 January 1973, Implementation of SAL Agreements. The Under Secretary of Defense for Acquisition, USD(A), ensures that all DoD programs are in compliance with U.S. strategic arms control obligations. The Service Secretaries, Chairman of the Joint Chiefs of Staff, and Agency Directors ensure the internal compliance of their respective organizations. The DoD General Counsel provides advice and assistance with respect to the implementation of the compliance process and interpretation of arms control agreements.

DoD Instruction S-5100.72 establishes general instructions, guidelines, and procedures for ensuring the continued compliance of all DoD programs with existing arms control agreements. Under these procedures questions of interpretation of specific agreements are to be referred to the USD(A) to be resolved on a case-by-case basis. No project or program which reasonably raises an issue as to compliance can enter into the testing, prototype construction, or deployment phases without prior clearance from the USD(A). If such a compliance issue is in doubt, USD(A) approval shall be sought. In consultation with the DoD General Counsel, OASD/International Security Policy and OJCS, the USD(A) applies the provisions of the agreements, as appropriate. Military departments and DoD agencies, including SDIO, certify internal compliance quarterly and establish internal procedures and offices to monitor and ensure internal compliance.

In 1985, the United States began discussions with allied governments regarding technical cooperation on SDI research. To date, the U.S. has concluded bilateral SDI Research Memorandums of Understanding with the United Kingdom, Federal Republic of Germany, Israel, and Italy. All such agreements will be implemented in a manner consistent with U.S. international obligations, including the ABM Treaty. The Administration has adopted guidelines to ensure that all exchanges of data and research activities are conducted in full compliance with the ABM Treaty obligations not to transfer to other states ABM systems or components limited by the Treaty, nor to provide technical descriptions or blue prints specially worked out for the construction of such systems or components.

CATEGORIES OF TREATY COMPLIANT ACTIVITIES

There are three basic types of SDI activity that are permitted under the compliance policy the United States has adopted with respect to the ABM Treaty. The SDI major experiments described below are grouped according to these categories.

Category 1 - Conceptual Design or Laboratory Testing. This activity precedes field testing and was considered during the ABM Treaty negotiations to be research that was not verifiable by National Technical Means (NTM) and not subject to Treaty limits.

Category 2 - "Field Testing" of Devices That Are Not ABM Components or Prototypes of ABM Components. As noted earlier, Article V prohibits the development, testing, and deployment of ABM systems or components which are sea-based, air-based, space-based, or mobile land-based.

The negotiating record of the ABM Treaty shows it was clearly understood in 1972 that "development" begins when field testing is initiated on a prototype of an ABM component. The definition of "development" applied to the Article V limitations results in the prohibition of field testing of ABM systems or components, or their prototypes, which are other than fixed land-based. Thus, SDI field tests of space-based or other mobile-based devices cannot involve ABM components or prototypes (or ABM systems or their prototypes). All SDI Category 2 experiments must meet this criterion. For any device to be limited by the ABM Treaty, whether labeled "prototype" or some other term of art, it must constitute an ABM system or component (an ABM interceptor missile, ABM launcher, or ABM radar) or be capable of substituting for such an ABM component.

"ABM systems and components" are defined in Article II as follows:

> For the purpose of this treaty an ABM system is a system to counter strategic ballistic missiles or their elements in flight trajectory, currently consisting of (a) ABM interceptor missiles, which are interceptor missiles constructed and deployed for an ABM role, or of a type tested in an ABM mode; (b) ABM launchers, which are launchers constructed and deployed for launching ABM interceptor missiles; and (c) ABM radars, which are radars constructed and deployed for an ABM role, or of a type tested in an ABM mode.

We are applying the rule that all SDI "field tests" not involving fixed, land-based devices must not be conducted in an "ABM mode." The term "tested in an ABM mode" is specifically addressed in a classified Agreed Statement negotiated in 1978 by the U.S. and U.S.S.R. and in the Standing Consultative Commission. That agreement provides, in part, that an interceptor missile is considered to be "tested in an ABM mode" if it has attempted to intercept (successfully or not) a strategic ballistic missile or its elements in flight trajectory. Like-

wise, a radar is considered to be "tested in an ABM mode" if it performs certain functions such as tracking and guiding an ABM interceptor missile or tracking strategic ballistic missiles or their elements in flight trajectory in conjunction with an ABM radar which is tracking and guiding an ABM interceptor missile. "Strategic ballistic missiles or their elements in flight trajectory" include ballistic target-missiles with the flight trajectory characteristics of strategic ballistic missiles or their elements over the portions of the trajectory involved in testing.

Category 2 experiments must also meet the obligation of Article VI not to give non-ABM launchers, missiles, or radars capabilities to counter strategic ballistic missiles or their elements in flight trajectory and not to test them in an ABM mode.

Allowed Category 2 activities include tests of experimental devices to demonstrate technical feasibility of advanced defenses and gather data prior to construction of a prototype of an actual ABM component. Tests of non-ABM systems performing functions consistent with Treaty obligations (such as air defense and early warning) are also legitimate Category 2 activities.

Category 3 - "Field Testing" of Fixed Land-Based ABM Components. "Field Testing" of fixed land-based ABM components or systems is permitted as long as other Treaty provisions are met. Under Article IV, all such tests must take place at agreed ABM test ranges (for the U.S., White Sands Missile Range and Kwajalein Missile Range), and the total test ABM launcher count must not exceed 15.

Such testing must comply with limitations in Paragraph 2 of Article V on launcher capabilities as follows:

> Each party undertakes not to develop, test, or deploy ABM launchers for launching more than one ABM interceptor missile at a time from each launcher, nor to modify deployed launchers to provide them with such a capability, not to develop, test, or deploy automatic or semi-automatic or other similar systems for rapid reload of ABM launchers.

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Agreed Statement E prohibits "developing, testing, or deploying ABM interceptor missiles for delivery by each ABM interceptor missile of more than one independently guided warhead."

Summary

The SDI projects and experiments have been reviewed to ensure that they will be conducted in accordance with one of the three categories of activities permitted by the Treaty.

The Services and SDIO are obligated to plan and implement these experiments in a compliant manner. Many of the SDI devices do not use traditional technology, but are "based on other physical principles" (such as lasers). In these cases, we have reviewed them by considering their capability to substitute for traditional ABM components, and whether they will be "tested in an ABM mode" by analogy to the 1978 Agreed Statement (which does not address devices based on new technology).

COMPLIANCE ASSESSMENT

The entire SDI Program is compliant with the ABM Treaty and all other U.S. treaty obligations. The bulk of the near-term effort consists of technology research projects that support major experiments to be conducted by the SDI Program. Seventeen major experiments and their bases for compliance are summarized below. Three experiments, Space Surveillance and Tracking System (SSTS), Space-Based Hypervelocity Rail Gun (SBHRG), and the High-Brightness Relay (HIBREL) Project, are not considered this year because they are not funded in the requested program. Other experiments have been revised substantially since last year.

ALPHA is a ground-based laser device designed to demonstrate the feasibility of high-power infrared (IR) chemical lasers for space-based applications. The Large Optics Demonstration Experiments (LODE) and Large Advanced Mirror Program (LAMP) are to demonstrate critical beam control and large lightweight space optics technologies, respectively, in a series of ground-based experiments simulating the space environment. All of these tests are under-roof experiments using devices incapable of achieving ABM performance levels (Category 1).

The SKYLITE program, which consists of the MIRACL laser and the Sea Lite Beam Director subsystems from the former Navy Sea Lite program, will be integrated into an experimental device for ground-based lethality testing against fixed targets at White Sands Missile Range and for high-power propagation tests designed to investigate adaptive correction techniques to compensate for the effects of thermal blooming and atmospheric turbulence. An attempt will be made in a ground experiment to efficiently integrate a laser and beam director which, separated or combined, are not capable of substituting for an ABM component. Neither the power nor the optics are compatible with atmospheric propagation at ranges useful for ABM applications. Experiments are planned against ground-based static targets and airborne instrumented vehicles. The device is not a prototype nor is it ABM capable (Category 2).

The space Tracking and Pointing Experiment (TPE) program will concentrate on a series of experiments with increasing degrees of difficulty, technologies required for tracking and pointing of weapons, and sensors for space- and ground-based applications. Current plans call for a shuttle and free-flyer experiments over the next few years. These devices will also not be capable of achieving ABM performance levels. As these plans become better defined, they will be reviewed to ensure they are in compliance (Categories 1 and 2).

The ground-based Free Electron Laser (FEL) program includes the fabrication at the White Sands Missile Range (WSMR) of an experimental laser to perform an uplink experiment to an instrumented spacecraft which will measure beam properties. Longer-term plans include upgrading this experimental facility to higher power. Should it achieve ABM capability, the fixed ground-based FEL would be compliant with the ABM Treaty because it will be located at an agreed ABM test range (Categories 2 and 3).

The Neutral Particle Beam Technology Integration Experiment has been significantly reduced in scope due to budgetary limitations. The experiment will be designed to investigate the technologies needed to perform midcourse discrimination or detect nuclear material. This experiment will be conducted in space at low average power using nearby, co-orbital, instru-

mented targets, and the device will not be capable of autonomously acquiring or tracking ballistic targets. Because of such limitations, this experimental device will not have ABM capabilities. This experiment will not be tested in an ABM mode (Category 2).

The Boost Surveillance and Tracking System (BSTS) experiment is a space-based experiment (which is not yet fully defined) to demonstrate technology capable of upgrading the current space-based early warning system. This experiment will, if successful, also permit a decision to be made on the applicability of more advanced technology for ABM purposes. The experiment will determine if sufficiently sensitive tracking and signature data can be collected on orbit against the earth's background. The BSTS experimental device will not be a prototype of an ABM component and will be limited in capability of performing early warning functions which are permitted by the Treaty. For example, the experimental BSTS will collect ballistic missile plume data, but it will not be capable of real-time data processing for handing off to a boost-phase interceptor. Other capabilities may be limited as well. It will not be tested in an ABM mode (Category 2).

The Airborne Optical Adjunct (AOA) experiment will demonstrate the technical feasibility of long-wavelength infrared (LWIR) acquisition, tracking, and discrimination of strategic ballistic missiles from an airborne platform to support a ground-based radar. The AOA experimental device will not be capable of substituting for an ABM component due to its platform and sensor limitations. The test platform will be a Boeing 767; the ultimate airborne platform is yet to be determined. The endurance of the test platform is significantly less than that needed for the operational concept. The AOA experiment uses a single, passive sensor. As part of the feasibility demonstration, the AOA experimental device will observe ballistic missile tests flown into the Kwajalein Missile Range (KMR). Any increase in the performance of the AOA experimental device or tests involving ABM interceptor missiles will require prior approval (Category 2).

The purpose of the Space-Based Kinetic-Kill Vehicle (SBKKV) project (which is not fully defined) is to determine the feasibility of target acquisition, tracking, and rocket-

propelled projectile launch and guidance. This feasibility may be demonstrated in experiments using space-based or ground-based devices or a combination of both. The demonstration hardware for any space-based experiment will not be an ABM component, will not be capable of substituting for an ABM component, and will not be tested in an ABM mode. There will be no intercepts of strategic ballistic missiles or their elements in flight trajectory in a space-based experiment. Tests involving fixed ground-based ABM interceptors may use ABM components and may be tested in an ABM mode, but will not involve field tests of a prototype of a space-based ABM component. As the plans become better defined, they will be reviewed to ensure compliance (Category 2 or 3).

The ground-based Hypervelocity Rail Gun research program is intended to validate the weapon potential of a hypervelocity gun and associated miniature kill vehicle technology. Several types of projectiles will be fabricated to demonstrate that precision-guided munitions can be successfully launched from hypervelocity guns. The test devices will not be ABM components and will not have ABM capabilities. They will demonstrate the capability to launch unguided and guided projectiles at hypervelocities from ground-based rail guns within a laboratory environment and will not involve testing in an ABM mode (Category 1).

The SATKA Integrated Experiment (SIE) will investigate technologies in netting together sensors on various platforms to accomplish end-to-end tracking of a strategic ballistic missiles. Passive tracking and handover will be attempted on test vehicles launched from Vandenberg AFB into the Western Test Range. The SIE project will use existing sensors, none of which are ABM components, nor will they be tested in an ABM mode. ABM interceptor missiles will not be involved in any of the experiments (Category 2).

JANUS is a single launch designed to gather signature information. No interception will be attempted with this experiment. This package will have no ABM capability and will not be tested in an ABM mode (Category 2).

The Flexible Lightweight Agile Guided Experiment (FLAGE), formerly called SRHIT, is a research program to explore small nonnuclear, hit-to-kill technology using off-the-shelf components combined with an active radar and small, multiple divert thrusters. FLAGE tests the seeker, guidance, and control technologies for a short-range interceptor at low altitudes. Tests will be conducted at WSMR to complete the FY86 SRHIT test series. Due to its very limited propulsion system, guidance, and radar range, this interceptor is not ABM capable. Additionally, it will not be tested in an ABM mode (Category 2).

The Significant Technical Milestone (STM) II experiment is a research program to characterize and generate a multispectrum sensor data base. A Delta 3910 launch vehicle will be placed in a low earth orbit. The experiment will evaluate state-of-the-art sensors. No interception will be attempted in this experiment. None of the devices used in this experiment are in strategic ballistic missile trajectory. The sensors will not be tested in an ABM mode, and will not be capable of substituting for ABM radars (Category 2).

The High Endoatmospheric Defense Interceptor (HEDI) project is to demonstrate the capability to intercept strategic ballistic missile warheads within the atmosphere. Tests at White Sands Missile Range (WSMR) under the Kinetic Intercept Test Experiment (KITE) program will involve interceptors flown to points in the atmosphere to verify missile integrity, characterize the flight environment, and perform interceptions on targets in trajectories not characteristic of strategic ballistic missile trajectories. The interceptors flown at WSMR will not demonstrate ABM capability, will not have sufficient propulsion to be ABM capable, and will not be tested in an ABM mode. Interceptor flights at Kwajalein Missile Range (KMR) under the HEDI program will involve the allowed tests of nonnuclear ABM interceptor missiles. The interceptors flown at KMR will be ABM capable and will be tested in the ABM mode. All flight tests will be from fixed ground-based launchers without the capability of being rapidly reloaded or launching more than one interceptor missile at a time. The interceptor missiles will not be capable of delivering more than one independently guided warhead (Categories 2 and 3).

The Exoatmospheric Reentry Vehicle (RV) Interceptor System (ERIS) is intended to engage incoming RVs from the time they separate from the post-boost vehicle bus until reentry into the atmosphere. This is an allowed test of a nonnuclear ABM interceptor missile. All interceptor missile flight tests are to be conducted from fixed ground-based launchers at KMR. A series of flight tests is planned. The ERIS interceptor will be ABM capable and will be tested in the ABM mode. Fixed ground-based launchers will be incapable of launching more than one interceptor missile at a time and will not be rapidly reloadable. The ERIS interceptor missile will not be capable of delivering more than one independently guided warhead (Category 3).

The Terminal Imaging Radar (TIR) will be an X-band ABM radar which will be tested in an ABM mode. Due to funding limitations, this program will incur a one-year delay in its previous schedule. This fixed land-based radar will be tested at an agreed ABM test range (i.e., KMR). The objective is to demonstrate performance and effectiveness of an X-band imaging ABM radar possibly in conjunction with the HEDI experiment at KMR. TIR will be permanently installed in an existing radar building and will require this building for structural support. TIR will perform target precommit discrimination and may handover to HEDI (Category 3).

The Long-Wavelength Infrared (LWIR) Probe project (which is not fully defined) will use a ground-launched LWIR sensor in a feasibility demonstration experiment to detect, discriminate, track, and designate midcourse targets. All tests will be conducted from a fixed land-based launcher at an agreed ABM test range. If the LWIR Probe, after it is better defined, is considered an ABM component, it must be fixed, land-based and can be tested only at an agreed ABM test range. Furthermore, it cannot be a prototype of a space-based ABM radar substitute. In the "pop-up" mode from a fixed land-based launcher, the LWIR Probe is not considered air-based or space-based (Category 3).

Senator LEVIN. My time is up.
Thank you, Mr. Chairman.
Senator EXON. Thank you.
Senator Cohen.
Senator COHEN. Thank you, Mr. Chairman.
I have some quick questions.

ERIS SYSTEM

Mr. Godwin, do you have a judgment as to whether the ERIS system, the exoatmospheric interceptors, is legal under the ABM Treaty, as narrowly defined?

Mr. GODWIN. I believe the work we have done indicates that it is. Yes.

Senator COHEN. Is that because it is not based on other physical principles?

Mr. GODWIN. No. I believe it is because it is not an ABM component or tested in the ABM mode.

Senator COHEN. That is the definition that brings it there.

Mr. GODWIN. Also, I am told it is a fixed land-based component permitted under the treaty.

Senator COHEN. It is fixed, land-based—that is the rationale for it?

Mr. GODWIN. Yes.

Senator COHEN. Rather than the technology itself?

Mr. GODWIN. Correct.

SPACE-BASED KINETIC KILL INTERCEPTOR

Senator COHEN. Have you examined the space-based kinetic kill interceptor?

Mr. GODWIN. I have not, no. But it has been reviewed.

Senator COHEN. By whom?

Mr. GODWIN. By others in our office, the Under Secretary of Defense, but not the question of compliance, however.

Senator COHEN. Would not that be important for you to review?

Mr. GODWIN. It would be. If there were a space test planned, it would be.

Senator COHEN. Has there been any analysis at this point about its compliance with the ABM Treaty?

[Pause.]

Mr. GODWIN. I am told there is a test planned, but we are not familiar with the details nor have we studied it for compliance.

General ABRAHAMSON. The tests will be conducted beyond the 1989 timeframe. Obviously, the way we propose each of these tests is the test itself is proposed. It is examined by the committee. An initial judgment is made, and many times there are concerns raised, because these are judgments that are not simple, black and white judgments.

I think it does illustrate the great difficulty in writing these kinds of treaties in such ways that they can be very, very simply judged. In that sense, I think part of the wisdom in the ABM Treaty itself is that it avoided the question of research fundamentally.

In terms of those particular experiments, very often the process goes on for a period of months. As we examine each of the experiments, questions are raised, and then it is judged whether we must change something. So the process of arriving at a fully compliant test is a process where we work against our test objectives. The committee raises questions that they think are either questionable or that need to be corrected. Then we go back and we adjust the test. So, when the test finally is conducted, it is fully compliant, and fully compliant not only by the committee itself within the Department of Defense, but it is submitted in our annual report and is reviewed by ACDA, the State Department, the NSC, and, of course, the Congress.

Mr. GODWIN. The distinction should be made whether we carry out a continuing surveillance and study of all the tests made in the future or those that are submitted to us for determination of compliance. The latter is what I am talking about.

We would review them at the time there was a plan describing the test, and we would render a judgment as to whether or not it conformed with the ABM Treaty.

Senator COHEN. In other words, you do not want to reach any premature judgment until such time as it is ripe for the test?

Mr. GODWIN. Correct. Not until the time that it can be properly analyzed.

Senator COHEN. That is all I have, Mr. Chairman. Thank you.

Senator EXON. Thank you.

Senator Glenn.

Senator GLENN. I have no questions at this time. Thank you.

Senator EXON. Senator McCain.

Senator MCCAIN. No questions, Mr. Chairman.

Senator EXON. Senator Nunn.

Chairman NUNN. Are we questioning both witnesses now?

Senator EXON. We are questioning basically only Secretary Godwin, who has to leave. We are going to have a following round after General Abrahamson makes his presentation.

Chairman NUNN. Fine.

I would just like to ask Mr. Godwin one question.

ERIS SYSTEM

Would you give us again your reasoning on the answer to Senator Cohen's question about the deployment of the ERIS system. I believe you said you thought it could be deployed in a fixed, land-based mode. Could you tell us why?

Mr. GODWIN. I don't think I used the word "deployed." The tests are going to be conducted in a fixed-based mode at a predetermined, acceptable site, I think in this case White Sands, which is permitted under the treaty.

Chairman NUNN. Does that mean the ERIS is based on other physical principles or that ERIS is not based on other physical principles and is existing technology, as defined in the ABM Treaty?

Mr. GODWIN. This particular one is under review, and I do not think we have the answer to your question.

It is being considered for this test because of its nature, and the fact that it will be a fixed, land-based system.

Chairman NUNN. You said that it was not a component. Did you mean that?

Mr. GODWIN. It would not be considered as a component.

Chairman NUNN. Why is that?

Mr. GODWIN. It could be in the future, but in the present mode, it is not.

Chairman NUNN. Are you saying that the ERIS system is, then, an adjunct?

What are you saying?

Mr. GODWIN. I am told that it would be tested as a fixed-base component for future use, but in its present configuration, it is not.

[Additional information follows:]

ERIS SYSTEM

The following is provided to clarify previous testimony.

The ERIS is intended to engage incoming RVs from the time they separate from the post-boost vehicle bus until they reenter into the atmosphere. If deployed, ERIS will be a fixed, land-based, non-nuclear, ABM interceptor missile as allowed by the ABM Treaty. We will conduct ERIS flight tests from fixed ground-based launchers at Kwajalein Missile Test Range (an approved ABM test range). The ERIS test interceptor will be ABM capable and will be tested in the ABM Mode. Fixed ground-based ERIS launchers will not be capable of launching more than one interceptor missile at a time and will not be rapidly reloadable. Additionally, the ERIS interceptor missile will not be capable of delivering more than one independently-guided warhead.

Chairman NUNN. It is designed to be a component, is it not?

Mr. GODWIN. Eventually.

Chairman NUNN. General Abrahamson, what do you say?

General ABRAHAMSON. I'm sorry, but I did not hear your last question, Senator.

Chairman NUNN. The ERIS system in designed to be a component, is it not?

General ABRAHAMSON. When it is fully researched and then deployed, it would be a component, based on my understanding of the treaty, which defines an interceptor as a component. Then that would be a component in the deployed mode.

Chairman NUNN. Thank you, Mr. Chairman.

Senator EXON. Senator Warner.

Senator WARNER. Thank you, Mr. Chairman.

My question is to Secretary Godwin.

ABM TREATY INTERPRETATION

Should a decision be made to go to the broad interpretation and the department conducts the balance of the program under the broad interpretation of the ABM Treaty, are there any tests that would be required that would still be precluded by the ABM Treaty itself?

Mr. GODWIN. Even with the broad interpretation?

Senator WARNER. Yes.

In other words, we are under the narrow or restrictive interpretation now, and then we go to broad. Are there still some restrictions under that treaty which, even with the broad interpretation,

would preclude certain testing that would pertain to any decisions to develop the system?

Maybe General Abrahamson would want to join in that answer.

Mr. GODWIN. I would welcome his comments. I do not think we have been exposed to those options, but I am sure the General has.

General ABRAHAMSON. Sir, I think the key point that Mr. Godwin made is that that has to be considered very carefully.

I think that if there were a decision to go to the broad interpretation of the treaty, with my understanding of it—and there are clearly some ambiguities that then have to be considered—a decision to go to the broad interpretation of the treaty is not then a complete open and unrestricted way in which you can proceed all of the way into the development. Furthermore, you certainly cannot begin into a deployment process.

Senator WARNER. That is the way I also read the treaty, that even though you go to the broad interpretation, there remain some restrictions. It just is not a free license to do what you want.

Chairman NUNN. I could not understand your last words. You said something is not what?

General ABRAHAMSON. Maybe I am not explaining myself very well, sir.

My judgment is that even a decision to go to the broad interpretation would then require all of us to examine a new set of treaty and legal problems in terms of some of the capabilities of some of the experimental devices. They would fall into several categories.

One category would surely be does it have residual operational capabilities, such things as that.

This is only a personal judgment at this point, and certainly I am not a lawyer in the treaty. That has to be judged by people other than my staff. But I think what the broad interpretation of the treaty does is to offer additional freedom for testing. It would also open up an additional set of questions that would have to be examined with the same care that we are now using to stay within the narrow interpretation of the treaty.

Chairman NUNN. If I understand what you are saying, if I could ask, the line would then become what is a test versus what is a deployment of an operational system?

General ABRAHAMSON. I think that would have to be looked at very, very carefully. Yes, sir.

Senator WARNER. If we proceeded under the broad interpretation, it would be less expensive, quicker, and in all likelihood get to a better system; and then you still have impediments under the ABM Treaty which, presumably, if the treaty itself under the 6-month clause were to be abrogated by this country, you could, even after the broad interpretation, perhaps move more quickly, in a less costly way, and develop a better system. Would that be correct?

General ABRAHAMSON. Sir, I believe that that would essentially be the correct scenario, yes.

Senator WARNER. I thank the Chairman.

Senator EXON. I have just one short question, Secretary Godwin, and then we will excuse you if there are no other questions by the members of the subcommittee.

I will quote from your statement: "As a matter of policy, the SDI program has not been restructured to take advantage of the broader interpretation of the ABM Treaty which the President determined to be fully justified."

I guess the question in my mind is this: If the administration intends to abide by the restrictive interpretation of the ABM Treaty, what was the reason for the publicity and the statements from the administration stating that the broad interpretation was the correct one?

What was gained or sought by reinterpreting this treaty?

Mr. GODWIN. I don't know the rationale for the publicity. I know that the opportunities are presented for new areas of investigation if the broader interpretation is used. But, beyond that, I am unaware as to the reason for the unusual publicity associated with it.

Senator EXON. Well, I will just tell you, Mr. Godwin, that it is the sense of this Senator, who has been supportive of SDI, and in listening to many of my colleagues on both sides of the aisle, that there is a great deal of confusion today as to what exactly is taking place.

I do not believe, as I indicated in my opening statement, that this has been particularly advantageous to SDI.

I would just say that there is some question up on the Hill these days, both in the House and in the U.S. Senate, as to whether or not those of us who are pressing ahead on some reasonable level of SDI funding are finding ourselves in the position where, by so doing, we are directly or indirectly suggesting that we break out of the ABM Treaty.

While there are lots of differing points of view, I would suspect that the majority point of view, from what I have heard, is that breaking out of the treaty is not something that most Members of Congress see as a viable option at this time.

Are there further questions?

Senator COHEN. Yes, Mr. Chairman.

Senator EXON. Senator Cohen.

Seantor COHEN. I would clarify one other point.

General Abrahamson, last week before this subcommittee you testified that the deployment of 100 ERIS interceptors would be legal under the ABM Treaty, the deployment would be legal, but that you decided not to exercise that option.

Why would it be legal in your judgment? Is it because it is a traditional system?

General ABRAHAMSON. Yes, sir. That is obviously my interpretation in my answer to that. But it is because it is a fixed, land-based component.

Senator COHEN. It is not an exotic, in your judgment?

General ABRAHAMSON. The treaty does not use the word "exotic," sir. The treaty uses "other physical principles."

Senator COHEN. Well, in your judgment, however, it is not an exotic system?

General ABRAHAMSON. I have never examined it in that particular way. I have examined it and the committee and the people who have looked at it very carefully feel that it falls quite clearly

within the category of the traditional component that could be deployed.

Senator EXON. Senator Gore.

Senator GORE. Mr. Chairman, I would like to defer since I have just arrived and will listen to my colleagues' questions at the moment.

Senator EXON. There is one other question from Senator Levin.

Senator LEVIN. Mr. Godwin, has your office defined the meaning of "other physical principles" within Agreed Statement D of that treaty?

Mr. GODWIN. No, we have not.

This particular subject is under considerable study now, and we are watching the outcome of the study. We are not doing it ourselves.

Senator LEVIN. You are not participating in that study?

Mr. GODWIN. No.

Senator LEVIN. I have just one question to follow up on what General Abrahamson said.

You used the term "residual operational capabilities," and I did not understand what you meant by it or what the relevance is at this point when we are clearly not at the deployment phase.

General ABRAHAMSON. That is correct. I think we are not in the deployment phase.

I think the question, if I understood the sense of Senator Warner, was, would moving to the broad interpretation or the legally correct interpretation, as it has been stated and so called, mean that we are really opening up in a very broad way the interpretation, does that mean that you can go ahead? I think the answer is no, that there are a series of legal barriers that have to be very carefully examined.

One of those barriers, which then becomes quite important, is, what is the difference between deployment and some of the experiments that we would have.

Senator LEVIN. What was the term "residual operational capability" used for? Is it related to that issue?

General ABRAHAMSON. Yes, sir. It is.

Senator LEVIN. What is a test or development and what is a deployment?

General ABRAHAMSON. Yes, sir. It is, in my judgment.

Chairman NUNN. Mr. Chairman.

Senator EXON. Senator Nunn.

Chairman NUNN. I would like to follow up on Senator Cohen's question because I think this is pretty interesting.

DEPLOYING THE ERIS SYSTEM

If the ERIS system can be deployed, as you testified and as you have just testified you believe it is because it would be traditional technology, what, then, is the difference between that system and the system known as SBKKV, which is, as I understand it, a space-based part of that, or similar to that but is space-based kinetic? What is the difference in technology?

Is there a fundamental difference in technology?

General ABRAHAMSON. In terms of the technology, first of all, there are many similarities in terms of its component. ERIS is self-guided. It is IR homing. There are many things like that. It is certainly nonnuclear. And in that respect, it is similar to some of the characteristics of the space-based interceptors.

I believe, sir, that you may be aiming at the legal judgment: is a space-based interceptor "other physical principles," and if it is, then why isn't an ERIS other physical principles.

Chairman NUNN. You anticipated my question.

General ABRAHAMSON. Yes, sir.

Frankly, I believe that this has to be a very important part of the examination that is on-going, and in a sense, those kinds of judgments are under review.

Chairman NUNN. But what I am asking you now is not a legal question but a technological question to which I do not know the answer. Is there a fundamental technological difference between those two systems?

General ABRAHAMSON. In terms of some of the components, the guidance elements, some of those, there are not major differences that would fall in those categories.

Whether or not—and here I am just not in a position to say—what aspect of a legal judgment that would apply to basing or the conditions of the types of technology, I am just not in a position to comment on.

Chairman NUNN. What you are saying is there is no fundamental technological difference, and if there is a difference, it is going to have to be found through a legal mechanism?

General ABRAHAMSON. No, I am not saying that.

Chairman NUNN. Well, that is what I read, because I have asked you three times what the fundamental technological difference is and you have basically said, I think candidly, that there is none.

General ABRAHAMSON. And I believe that, in terms of the kinds of technology involved in each one, that that is the case.

How that is all looked at legally I do not know and I cannot conclude.

Chairman NUNN. Well, there are quite a few legal mechanisms that seem to be running around.

The significance of that, Mr. Chairman, I think is important, that is, what we have just heard in answer to Senator Cohen's question. What General Abrahamson has just said very candidly is that he does not see any fundamental technological differences between those two systems. He has also said that the ERIS system is a ground-based fixed system, and to be able to deploy that, which he said we could do, it has to be deemed traditional technology and not other physical principles.

If you carry through Senator Cohen's question to a conclusion, what that means is the space-based version of the kinetic system is also, in all likelihood not based on other physical principles but existing technology.

If you take that one step further, what that means is even if the broad interpretation applies, which permits testing of other physical principles, this particular system, which is now being looked at for possible early deployment, could not be tested under the broad interpretation any more than it could be tested under the tradi-

tional interpretation. That is the conclusion that at least I have reached, unless it is refuted.

What this means is that this whole exercise that we are going through, in terms of broad versus traditional interpretations, in all likelihood, has no bearing on the question of testing the system which has been slated for early deployment.

I am crushed that all of my legal work is irrelevant.

I wonder how Judge Sofaer feels when he figures that out.

General ABRAHAMSON. May I comment, though I am not in the legal area.

Senator EXON. Before you comment, General, let me say that at 10 o'clock there is what I understand to be a rather brief ceremony in honor of Senator Zorinsky in the Rotunda of the Russell Building, and we are going to recess in 2 minutes for that matter. We will reconvene here at 10:30.

So I will give you 2 minutes to answer the Senator's question and with that we will recess. I would hope all witnesses could come back at 10:30, and we will get you out of here, Mr. Secretary, before 11 o'clock.

Senator GLENN. Will the Senator yield for a moment?

I cannot stay right now, but I will be back later on. I have a statement that I would like to have entered into the record.

Senator EXON. Without objection, it is so ordered.

[The prepared statement of Senator Glenn follows:]

PREPARED STATEMENT BY SENATOR JOHN GLENN

Mr. Chairman, the Strategic Defense Initiative Organization (SDIO) is requesting $100 million in military construction funds for 1988. These funds are to be used to build a National Test Facility (NTF) at Falcon Air Force Station in Colorado Springs, Colorado as part of the SDI National Test Bed project. While awaiting the construction of the NTF, the SDIO will temporarily occupy a part of the Consolidated Space Operations Center (CSOC) also located at the Falcon Air Force Station.

I believe that an existing facility in Ohio could well meet SDIO's needs as a NTF for both an interim and permanent basis at a reduced cost to the American taxpayer. The Department of Energy's spacious and modern Portsmouth Gas Centrifuge Enrichment Plant (GCEP) at Piketon, Ohio has been determined to be excessive to DOE's needs and is vacant and available to other government organizations.

I led a congressional delegation to visit the Piketon facility with General Abrahamson in January. I would like to emphasize to the subcommittee that the idea for using the Piketon GCEP facility as a site for the NTF did not come from me, but first originated with the SDIO who had sent a team of officials to Piketon. These SDIO officials concluded that the Piketon facility showed promise as a possible location for the NTF.

I have already requested that the Government Accounting Office (GAO) evaluate the NTF site surveys and/or construction plans made by the SDIO for the GCEP and Falcon Air Station facilities. I hope to receive a preliminary assessment of the GAO before mark-up of this committee is completed.

SDIO's site selection evaluation factors for the NTF were weighted heavily in favor of physical proximity to existing military facilities located in Colorado. In my opinion, the site selection criteria were pre-ordained to place the NTF in Colorado. While geographic proximity for such facilities is always desirable, in this time of sophisticated communications, such proximity is hardly necessary and in a military sense not a wise decision.

Accordingly, I intend to recommend to the Readiness Committee that the military construction funds for the NTF be fenced pending completion of this report.

If the GAO determines that there will be only marginal if any savings to the government from putting the NTF at the pre-existing Piketon facility instead of building a brand new building at a cost to the American taxpayer of $100 million, I can accept that. However, I believe that the Piketon facility could fully meet the needs of the SDIO, if not as a location for the NTF, then is some other capacity. In this

time of mounting budget deficits and the increasing likelihood that the defense budget will experience little or no real growth over the next several years, it is particularly important for the Department of Defense to avoid costly construction costs when existing facilities are available.

Senator EXON. Now, please answer Senator Nunn's question if you can.

General ABRAHAMSON. Yes, sir.

Sir, I was asked by Senator Cohen my judgment about whether or not this could be deployed. That is a technician's judgment.

Senator COHEN. No, no. Last week you testified that in your judgment——

General ABRHAMSON. That I thought it could be deployed.

Senator COHEN [continuing]. It could be deployed.

General ABRAHAMSON. That is correct.

Obviously, what that assumes is that there is a final judgment about exactly the point that Senator Nunn indicated.

I do not believe that a final judgment by the legal process has truly been made. And, frankly, in terms of the deployment of the ERIS, as a system, that is irrelevant in terms of the idea that we have no plans to deploy that.

Senator COHEN. No, no. It is not irrelevant. The question is: Is it, in fact, a traditional system, and not based on other physical principles. And according to your statement last week it, in fact, was a traditional system.

General ABRAHAMSON. That was my understanding of it.

Whether or not that final decision is made by people other than me. I think it is important to get that on the record.

Chairman NUNN. Is Judge Sofaer going to make the technological judgment about other physical principles?

General ABRAHAMSON. No, sir.

My responsibility is to support all of you, both in the Congress and in the administration, by providing a description of what the technologies are. It is not my responsibility to make a legal judgment.

Chairman NUNN. I agree with you. I agree with you and I applaud your candor, because that is exactly what we have to have to sort this out.

Senator GORE. And it is not Judge Sofaer's place to make a technological decision, either.

Senator LEVIN. And Secretary Godwin has not made it yet.

General ABRAHAMSON. No, but it is Judge Sofaer's decision to make a legal interpretation.

Senator EXON. The subcommittee will be in recess until 10:30.

[A brief recess was taken.]

Senator EXON. The subcommittee will please come to order.

Without objection, I ask that Senator Thurmond's opening statement be printed in the record.

[The prepared statement of Senator Thurmond follows:]

PREPARED STATEMENT OF SENATOR STROM THURMOND

Thank you Mr. Chairman.

I congratulate you for holding this second hearing on the Strategic Defense Initiative program. Last week, we had the opportunity in closed session to receive a briefing from General Abrahamson on some of the technical details of the program. While much of that testimony was classified, important unclassified information

came out in the hearing that bears directly on the issues of testing under the ABM Treaty and phased deployment options. I am hopeful, Mr. Chairman, that today's hearing will further develop that very interesting and very powerful testimony.

Mr. Chairman, I have been struck by how much of the SDI testing debate in recent months seems to miss the central issue that this committee and this Government should be committed to and that is what course of action best serves our national security interests. While I will not prejudge the studies that are presently underway at the President's direction, I am reminded of the concerns I expressed fifteen years ago in connection with the ratification of the ABM Treaty.

At that time, I noted that the treaty "overlooks the fact that present ABM deployment in the United States and the U.S.S.R. is not symmetrical." Fifteen years later, that situation still exists, and the Soviets now have years of operational experience in ground based ABM with their Moscow system.

I also noted that the treaty "effectively prevents us from ever having the means to protect our population from a Soviet first strike." At the time, the technologies that might afford such protection were only dimly on the horizon. Technological progress made in the interim, and the greater than anticipated progress in several of the critical research areas in the Strategic Defense Initiative, have brought us to the threshold of decisions that could well determine whether this Nation will be able to defend itself against ballistic missiles in this century.

Mr. Chairman, as we approach that threshold, I believe it is essential that we in the Congress not foreclose the options available to the President by legislative constraints on the SDI testing program or crippling reductions in the level of SDI funding.

Mr. Chairman, I join with you in welcoming Dr. Godwin for his first appearance before the Strategic Subcommittee, and in welcoming back General Abrahamson, whom we are always glad to see. While Dr. Godwin's portfolio as the Under Secretary of Defense for Acquisition is very broad, it is my understanding that he is here today to address his specific responsibilities related to the compliance of Department of Defense development activities with our treaty obligations. General Abrahamson, consistent with his responsibilities, is here to address the status of the program. I look forward to the testimony of both of these gentlemen.

Mr. Chairman, neither of these witnesses has broad policy responsibilities with respect to the SDI program. To the extent that our colleagues have questions along such policy lines, it may be necessary to have an additional hearing with the appropriate administration officials present.

Senator EXON. I would ask the members of the subcommittee at this time if there are further questions of Secretary Godwin, since we had agreed to get him out of here within the next few minutes.

Are there any further questions for the Secretary?

Senator LEVIN. Yes, Mr. Chairman.

Senator EXON. Senator Levin.

Senator LEVIN. Thank you, Mr. Chairman.

Secretary Godwin, I have just a few additional questions raised by that last exchange.

SPACE-BASED KINETIC KILL VEHICLE

I understood from your answer to my question that your office has not decided yet whether or not the space-based vehicle, the kinetic kill vehicle, is based on other physical principles. Is that correct?

Mr. GODWIN. Yes.

Senator LEVIN. That is correct.

Now, there is a process to decide this, I gather from your statement, and you have described that process at some length.

Can you tell us where, in the process, we are on that issue inside your department?

Mr. GODWIN. You are speaking not of the overall process but of the process of making a determination as to whether something is based on other physical principles or not?

Senator LEVIN. Yes—whether or not that particular experiment, that space-based kinetic kill vehicle experiment, is or is not based on other physical principles? Have you started the process of determining that issue yet?

Mr. GODWIN. We have started the process, but we are watching the overall study which is ongoing as to what the determination is going to be. We are not making that specific determination ourselves.

Senator LEVIN. Well, who is going to make that determination if it is not you? You run the Compliance Office, don't you?

Mr. GODWIN. We run the Compliance Office to conform to established policy or guidelines, but we do not establish the guidelines in the policy sense.

Senator LEVIN. I understand.

Who, then, is going to establish that policy? Who is going to make the determination as to—well, let me go back.

You say the policy has not been decided yet.

Mr. GODWIN. Yes.

Senator LEVIN. OK.

After the policy is decided, then you will apply it to that particular experiment?

Mr. GODWIN. Yes.

Senator LEVIN. When will the policy be set? What is the timetable on that?

Mr. GODWIN. I don't know. We are hoping it will be set in the next few weeks.

Senator LEVIN. How long after the policy is set will it take your office to apply the policy to that particular experiment to see if it fits?

Mr. GODWIN. Once the experiment is explained and is understood in detail, I imagine it would take us several weeks to make a determination.

Senator LEVIN. Do you know whether the policy decision that we have been talking about will define the words "other physical principles?"

Mr. GODWIN. I do not know precisely, but I am anticipating that it will.

Senator LEVIN. But, until those words are defined by the policymakers, you are not in a position to apply it to that particular test and experiment, is that correct?

Mr. GODWIN. That is correct.

Senator LEVIN. And after it is so defined by the policymakers, then it would take you at least a few weeks to apply the policy or the standards to the particular experiment?

Mr. GODWIN. That's correct.

Senator LEVIN. Are you or your office involved in the making of the policy itself?

Mr. GODWIN. Indirectly. We are asked for advice and we provide it to them.

Senator LEVIN. Have you been asked for advice on the question of the meaning of "other physical principles?"

Mr. GODWIN. Me, personally?

Senator LEVIN. Your office. You or your office.

Mr. GODWIN. Not to my knowledge. This does not mean that it has not occurred.

Senator LEVIN. Would your assistant know?

And I'm sorry, I should remember your name, but I do not. I apologize.

Mr. MINICHIELLO. My name is Lee Minichiello. We have had no formal request. Informally, we help whenever someone asks us.

Senator LEVIN. Has there been any written material submitted to anybody by your office on this issue?

Mr. GODWIN. No, there has not.

Senator LEVIN. If you have given oral advice on this issue, which apparently you have, would you summarize that advice for us?

Mr. GODWIN. I am not too sure that we have given oral advice on this subject.

Senator LEVIN. I thought you said that you had been giving some advice orally or informally.

Mr. MINICHIELLO. We have submitted our understanding of some of the past negotiating history.

Senator LEVIN. I cannot quite hear you.

Mr. MINICHIELLO. We have been asked questions with respect to what the negotiating history might bear on this.

Senator LEVIN. What the negotiating history might be on those words?

Mr. GODWIN. On that subject—but we have not provided any advice on an interpretation of our own.

Senator LEVIN. But you have given advice on what was in the negotiating history relative to those words?

Mr. GODWIN. Yes.

Senator LEVIN. Orally, or in writing, or both?

Mr. MINICHIELLO. Informally, orally.

Senator LEVIN. All right.

Could you summarize what that advice is?

Mr. MINICHIELLO. The negotiating record is classified.

Senator LEVIN. That is classified advice that you gave orally. OK, then.

Thank you very much.

Let me just ask one additional question, if I could, Mr. Chairman.

Senator EXON. Go ahead.

Senator LEVIN. Does this then mean, Secretary Godwin, that there are no experiments in 1988 or 1989 for which a definition of "other physical principles" is relevant to a determination of compliance?

Mr. GODWIN. I believe for those tests on which we have been asked to make a determination, the question of "other physical principles" has not been a critical factor.

Senator LEVIN. Or a relevant factor?

Mr. GODWIN. Or a relevant factor.

Senator LEVIN. And, as far as you know, you should be asked relative to any test or experiment where there reasonably could be an issue? Or where the definition might be important? Is that fair to say?

Mr. GODWIN. Yes.

Senator LEVIN. Do you decide what tests or experiments could reasonably raise a compliance issue, or does the SDIO decide which tests or experiments could reasonably raise a compliance issue?

Mr. GODWIN. The answer is both. It would originate with the SDIO. Then they would make a determination or a judgment and submit the tests or program to us for evaluation in conformance with the ABM Treaty. But it would arise with them and we would make a separate judgment.

Senator LEVIN. Thank you very much, Mr. Chairman.

Senator EXON. Senator Quayle.

Senator QUAYLE. Thank you, Mr. Chairman.

Are we just questioning Secretary Godwin?

Senator EXON. We are. I will explain once again that we are trying to get Secretary Godwin out of here by 11 o'clock.

By the way, let me say that, notwithstanding any other Senator coming in, Senator Quayle will be the last questioner, and we are directing our questions to the Secretary since he has to leave. The General has not even made his presentation yet, so I would ask you if you could, please limit your questions to the Secretary.

Senator QYAYLE. I will. I will always follow the rule of the Chair. I just wanted to make sure I knew exactly what it was.

I apologize for not being here earlier because I understand there was a rather interesting exchange, at least according to my staff, about whether this Delta 181 was prohibited even by Article III of the ABM Treaty, and there was some discussion of the fact that it was and, therefore, we did not even have to get into the debate of whether it was the narrow or the broad interpretation that was, in fact, banned by that.

I have been rather intrigued by this whole debate. This is a lawyer's dream. Of course, there are 62 of us in the Senate who are lawyers, so perhaps that is the reason that we get into these debates.

Quite frankly, I think we ought to be debating whether these systems are going to help defend the country and, obviously, if it is in our national security interest, there are just all sorts of options that we can have. But we have gotten involved in the nitty-gritty detail of arcane lawyers debate—which is fine. I mean, that seems to be the direction to go, so we will have to partake in it.

Let me see if I can just summarize for my own edification what I have been told by my staff to make sure that this is what was publicly stated.

ERIS SYSTEM

Since the seeker on the ERIS missile is, in fact, on a conventional system, a conventional interceptor, therefore that seeker, being placed on the KKV, would also make the KKV conventional and, therefore, prohibited under Article III and therefore would not have to get into that discussion of the broad and narrow interpretations.

Is that essentially what has been said and debated here this morning, Mr. Godwin?

Mr. GODWIN. That has been discussed here this morning, but I do not think it was resolved this morning. This question is being studied very closely and I do not believe we have an answer to it yet.

Senator QUAYLE. You don't have an answer to it?

Mr. GODWIN. No.

Senator QUAYLE. Well, it seems to me that what we are doing is taking this thing and saying that this adjunct—and I would say that the seeker would be an adjunct to the ERIS—since this is attached to a conventional system, therefore all of a sudden it is tainted or identified as being conventional also, even though it is, from my understanding, "other physical principles."

Senator LEVIN. Then it couldn't be deployed.

Senator QUAYLE. Pardon.

Senator LEVIN. Then it could not be deployed.

Senator QUAYLE. The issue, the thing I am trying to figure out is this. Go through this with me because you understand it.

Senator LEVIN. Senator Nunn and Senator Cohen were the ones who raised this. Senator Nunn is here, but I think I could do that now.

Senator QUAYLE. Let me go through it to make sure that I understand the argument.

It is that since ERIS is conventional, we have put a seeker on that system, and that therefore, the seeker is conventional, and, so would be barred by Article III, and we do not have to get into the broad interpretation versus narrow interpretation. We do not have to get into that discussion.

Chairman NUNN. ERIS would be permitted by Article III if it is——

Senator QYAYLE. Ground based.

Chairman NUNN. Yes.

Senator QUAYLE. But it would not be permitted under space-based. That is your argument, right?

Chairman NUNN. That's correct.

Senator QUAYLE. OK. It could not be space-based.

Chairman NUNN. I think everybody agrees with that, in terms of deployment. You have to divide it into deployment and testing.

Senator QUAYLE. OK. I am talking about testing.

Chairman NUNN. Well, that is a different question if you are talking about testing.

Senator QUAYLE. OK. I was not here for that discussion.

Chairman NUNN. I think I can state it for you.

The broad interpretation, the difference between the broad and the traditional is that the broad permits the testing of other physical principles.

Senator QUAYLE. Testing and development.

Chairman NUNN. If ERIS does not have other physical principles on the ground, query: does it have other physical principles when the same system virtually is put into space? We basically have been going through that this morning.

If it does not have other physical principles, the only point being made this morning, but a rather important one, is that the broad interpretation does not get you anything as far as testing that system in space because the case for testing under the broad interpretation is that it is other physical principles. That is the point.

Senator QUAYLE. OK. I follow you so far.

Now, the question would be if the seeker itself, the IR seeker, is other physical principles, which I assume that it is, that it is not based on technology that we had in 1972, if they take that seeker off something which the rest of it is in fact conventional or not OPP, by taking that off, the ERIS system, which would be ground based and putting that in space, are you, therefore, travelling with that and saying well, it is not any longer OPP, it has to be conventional?

What I am saying is can you take things out of what ERIS would be, which would be some old technology and some new technology, and take the new technology and put it into a space-based system for testing and development, which would get you into that broad interpretation? I guess I do not want to leave the impression that any other physical principle element or adjunct that you would put into the system is automatically tainted and, therefore, you could not take that out and test and develop—under the broad.

I am not saying that we have the broad. But that is my question.

Senator LEVIN. Would you yield?

Senator QUAYLE. Yes, I would yield.

Chairman NUNN. I don't know whether the seeker is other physical principles or not. We would have to refer to the technology. But I think the extension of your logic is if it is other physical principles, if the seeker is other physical principles, then the logic would say yes, you could test the seeker under the broad interpretation, but you could not send it up there on the rocket, because the rocket is "other."

So you would have to divide it.

The question you are asking is if you put something on a traditional system that is then another physical principle, does that make the whole system testable. I think that gets into a technological judgment and another judgment.

I am not sure you make the case that by having one part, one small adjunct of an overall component that is another physical principle, that you then can test the whole thing under the broad interpretation.

Senator QUAYLE. I guess what I am saying is then you get into the KKV and what that is, if that is other physical principles or not.

I think that the argument, at least the way I detect it, is that you have most of that on the ERIS, what you are talking about in the ERIS system, which is conventional technology that we had in 1972, although I think, and maybe that is a question that we have to have answered, but I would think that on the ERIS that they are talking about, that there is some OPP technology.

My question would be can we take that OPP technology under the broad and use that in a space-based testing of defense? Or is your argument going to say no, since you used it on this, the whole thing comes into the category that would be prohibited by Article III.

If that is the argument, then I would say that we have gone way too far.

Chairman NUNN. But it is not Article III that does the prohibiting in terms of the testing. It is Article V.

Senator QUAYLE. That is on the testing and development. But it refers to Article III as to what, in fact, the technology is prohibited from deploying. That is what it refers to. Article V refers to the components, at least the way we read it. If you read Agreed Statement D in there——

Chairman NUNN. You cannot deploy it under Article III if it is another physical principle.

I think that is the point General Abrahamson was making when he said that under Article III, that system, if it is ground-based, could be deployed, because it would be permitted under Article III if it is traditional technology. But by making the case that that can be deployed on the ground, you also refute the case that that is another physical principle that could be tested in space under the broad interpretation.

So, you can have it one way or the other, but you cannot have it both ways, unless the technology is fundamentally different between the space and the ground, and that is what General Abrahamson said was not accurate this morning. He said it was the same technology.

Senator QUAYLE. I guess that is a question we will have to get into, whether all of ERIS technology that we are talking about today is technology that we had in 1972, or is there some technology in the ERIS that would be in the definition of OPP. That, I think, probably, at least in my judgment, would be somewhat of a critical question. Then we may, in fact, say well, OK, we are going to have to have categories here of what is 1972 conventional technology, what is OPP, and we will get into some very important issues.

As I said, we are going to be getting into this debate. We will have to have it, and it will have to go forward.

Senator LEVIN [presiding]. Would you yield?

Senator QUAYLE. Unfortunately my time is up.

Senator LEVIN. Yes, your time is up, but if you would yield just for a question——

Senator QUAYLE. Yes.

Senator LEVIN [continuing]. If, in fact, that component is based on other physical principles, the ERIS system, how then would you be able to deploy it?

Senator QUAYLE. Are you talking about just the rocket to get into space, that that is technology from back in 1972?

Senator LEVIN. Whichever component is based on other physical principles would then make it nondeployable in a fixed, land-based system. It cannot use the components. It cannot deploy components.

Senator QUAYLE. Deploy—yes, deploy. I am talking about testing and development.

Senator LEVIN. The General has said that it can be deployed.

Senator QUAYLE. What can be deployed?

Senator LEVIN. ERIS.

Senator QUAYLE. It can be deployed, sure you can deploy a certain number of them.

Senator LEVIN. Because it is not based on other physical principles. That is what his testimony was at a different hearing.

Anyway, the chairman is now back.

Senator QUAYLE. May I ask just one more question.

Senator EXON [presiding]. All right, the chairman is back. We are going to get things under order.

Senator, I am going to give you 2 more minutes and then we will move on.

Senator QUAYLE. I will ask just one very general question.

We have had this debate up here and I guess it has gone on for quite some time this morning.

COMPLYING WITH THE TREATY

Just out of curiosity, Mr. Godwin, how much time do you spend and does your staff spend on making sure that we are in compliance? This may be an instructive lesson on Western democracy, on how we really go about providing for national security.

I would be curious about how much time you and your staff spend to make sure that we are technically complying with this treaty? Do you have any idea how many man-hours it costs? If not, I would sure be interested in some sort of computation sometime as to how much time, energy, and money we are really spending on this. This would be interesting to me.

We spend a lot of time on it here. Just look at the time we have gobbled up on this. And the chairman comes in and slams his gavel down and I almost didn't even get in a question. But he is generous to let me go beyond my 6 minutes.

Would you just answer that one question for me? If not, I would like you to furnish it for me for the record.

Mr. GODWIN. There are many man-hours devoted to it. We do, however, as I mentioned in my opening remarks, have a full-time Compliance Group, whose major role is associated with determining compliance of all the tests and programs to be carried out by SDI. The group consists of five people, full-time. This is, you might say, a second level of overview. Preceding that, each of the services and SDI have an overall responsibility by their commands to determine compliance. But, even after they make the determination, they are submitted to this Compliance Group, which is in the Office of the Under Secretary of Defense for Acquisition. The Compliance Group makes a final determination as to whether or not they comply with the AMB Treaty.

If you asked for an overall guess, I would say, in total, it is a lot of hours and a lot of people.

Senator QUAYLE. I would just be curious. I don't want you to go to a lot of work on this. Just ask somebody if they have any rough idea, and send me a letter on that, on how much time and what kind of expenditure of funds you really think this is.

Mr. GODWIN. A great deal of attention is devoted to insuring compliance, not only with this treaty, but with other treaties. We are rather satisfied that the job has been done well.

[The information follows:]

Within the Acquisition Organization there is an office with four professionals whose primary job is to oversee compliance. Additionally, the DOD Compliance Review Group, consisting of representatives from the JCS, General Counsel and Policy and chaired by Acquisition, provides direct compliance support on treaty issues. Additionally, each of these offices has individuals who support the compliance oversight function. External contractors also provide technical assistance in

the form of studies, analysis and background research. Considerable effort is often required by all agencies just to establish the proper interpretation of a single treaty provision on a specific program. The issue of the broad interpretation with respect to devices based on other physical principles, for example, has required extensive man hours of treaty and legal research within not only DOD, but State and ACDA as well.

Maintaining and supporting the Standing Consultative Commission (SCC), the body that deals with compliance issues raised by the United States and the Soviet Union, is an administration-wide activity that involves maintaining a delegation that meets with the Soviets twice a year in Geneva for about 2 months at a time.

Each service and DOD agency, including SDIO, has its own office to monitor internal compliance of their programs and may also have additional personnel at their field locations to monitor compliance. Each program manager who has a program which is affected by the ABM Treaty must ensure that the program is reviewed and maintained in compliance. Providing the briefings and reports necessary to satisfy the periodic compliance review process often involves substantial effort by these program offices.

Taken in total, many man-years are expanded by the Government on compliance issues resulting from our treaty obligations.

Senator QUAYLE. I am just curious as to how much time is being put into this.

Thanks for the indulgence of the Chair.

Senator EXON. I thank the Senator.

The Chair is somewhat undecided as to what the next order should be. Senator Thurmond is the ranking member of this committee and he has never been recognized even for a first round. So, at this time, I recognize my colleague, Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman. I will be brief.

CATEGORY II TEST

Dr. Godwin, how do you arrive at the judgment for a so-called Category II test, that they will not involve testing in an ABM mode, nor involve any device that possesses ABM capabilities?

Mr. GODWIN. Every test is analyzed individually, one on one. We devote many man-hours to determining what the tests are going to be, specifically to determine whether the questions raised by this category of whether or not they can be ABM components or operated in an ABM mode are answered. The subject is studied in great detail and an independent determination is made.

Senator THURMOND. Dr. Godwin, some have characterized the assessment of treaty compliance activities as being dependent on a very sharp pencil, by which I think they mean that the case is being stretched.

Do you view the compliance assessment in this way?

Mr. GODWIN. No, I do not.

The interpretation has always been the narrow one. The group is not an advocate, but a judge. They are looking for compliance in the strictest sense, and I think each determination will stand on its own two feet.

I am well satisfied that we are complying.

Senator THURMOND. Thank you very much.

Thank you, Mr. Chairman.

Senator EXON. Senator Humphrey.

Senator HUMPHREY. It is my understanding that Mr. Godwin has to leave soon. It that correct?

Senator EXON. Yes. In fact, I told him half an hour ago that he could leave in 5 minutes. He is still here. But you go ahead.

Can you stay for another 5 minutes?

Mr. GODWIN. I will stay for as long as you want me.

Senator HUMPHREY. I have not really had a chance to get warmed up on things since I have just come in. I want to wait. I will pass for now.

Senator EXON. Thank you.

I believe, Mr. Secretary, that we can now excuse you. We appreciate your patience this morning. There have been a lot of things going on both on and off the floor, and we are about ready to go into a vote. You are excused now. Thank you.

What is the feeling of the members of the subcommittee. A rollcall vote will be starting in 2 or 3 minutes. Do we wish to have General Abrahamson start with his testimony?

General, we do appreciate your patience.

What is the committee's pleasure?

Senator WARNER. Mr. Chairman, if I might speak, I would think we would be well advised to vote as quickly as possible and then reassemble so that we have continuity of this very important testimony that we are about to receive.

Senator EXON. Very well. We will stand in recess until 10 minutes after the hour, when we will reconvene.

[A brief recess was taken.]

Senator EXON. The subcommittee will reconvene.

General, we apologize to you for the morning delay. It has been pretty disjointed. It is just one of those things, but we are now ready to go to your testimony.

On the way back over here, I was fearful, once again, of the fact that the Soviet Union may figure out sometime that a key time for a surprise attack against the United States may be when the Senate is taking a key vote on a highly emotional, political issue with regard to the override of the President's veto. I am afraid that all would be lost.

With that in mind, that makes SDI even that more important, which may be of help to you.

Would you please proceed now with your presentation. I am sure that my colleagues will be coming back shortly. The vote was delayed by unanimous consent, and there was nothing we could do about that. That is why we were not back here at 10 minutes after the hour, as I had indicated.

So please proceed.

STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON, U.S. AIR FORCE, DIRECTOR, STRATEGIC DEFENSE INITIATIVE ORGANIZATION

General ABRAHAMSON. Thank you, sir.

Mr. Chairman, I do have a statement for the record.

Senator EXON. That will be accepted, without objection.

General ABRAHAMSON. I do believe, since there was this particular discussion and it revolved around so many areas of compliance, that it is important for me to read just one section of this statement. Normally I would just have submitted this for the record. I

will start on page 11. I believe it puts in context some of the discussion that has gone forward to this point, and I think it is important that it be brought forward. I hope that when some of the members return, they see that.

So, starting on page 11, I will make these comments. This is not my own comment. This is a statement for the record that goes beyond my own comment. I think it really represents an important perspective for all that is going on in the context of the discussions this morning.

The President decided in October 1985, as a matter of policy, not to restructure the SDI program in accordance with the broader interpretation of the treaty.

All statements in this testimony regarding compliance with treaty provisions should be understood to be based on the more restrictive interpretation. That is the way the program is structured. That is the way our budget is structured at this point.

The President has reserved the right to restructure the SDI program to take full advantage of the broader bounds of the ABM Treaty.

Third, because there are areas which are not fully defined in the ABM Treaty, it is necessary in some cases to infer specific standards for compliance. Three of the more important working principles are the following:

One, compliance must be based on an objective assessment of capabilities, which support a single standard for both sides and not on subject judgments as to the intent, which could lead to a double standard of compliance.

Two, the ABM Treaty, in Article V, prohibits the development, testing, and deployment of ABM systems and components that are sea-based, space-based, air-based, or mobile land-based. However, the treaty does not limit research and its associated testing short of field testing, of a prototype ABM system or component.

Next, the ABM Treaty, of course, restricts only defenses against strategic ballistic missiles. It does not apply to defenses against cruise missiles or defenses against nonstrategic ballistic missiles, provided that such defenses do not have ABM capability.

Perhaps the most important point of all, to end this with, is that the U.S. Government should guard against permitting a double standard of compliance, under which the Soviet Government could expect to violate particular provisions of arms agreements without consequence, while the United States continues to comply with all provisions.

The United States must reserve the right to respond to Soviet violations in appropriate ways, some of which may eventually bear on treaty constraints as they apply to the United States.

Now, I would like just to depart from this and to say that, as an American, I find this kind of concern over this Nation's legal obligation is what we all are trying to protect. This is obviously what the strategic defense is about, protecting not only our people but our way of life.

Therefore, it is a difficult process. It is one that we pay great attention to. It is one that I believe that, as the members of the committee or the staff fully understand, the great effort that is made on all of our parts to stay within the proper interpretation and the

policy and the efforts to do that, but still, meaningfully, make the program go ahead. You would see that we take this very, very seriously. It is not, as some of the people that Senator Thurmond commented on, that we are stretching. In fact, I think we are working very hard to do exactly the opposite.

This is a separate issue from the policy judgment of what really should be and what legally is the correct interpretation of the treaty.

My responsibility, as I said to Senator Nunn, is to support the administration and to support the Congress in making those judgments properly. I will endeavor to continue to do that, providing the technical advice so that you can make those kinds of judgment, and so that all the people involved can make those kinds of judgments.

In the end, however, we must find a way to make the program go forward. We are doing that. We are doing that with limited funding.

The whole exercise here is one of arms control, compliance with arms control properly on our side, and hope that there will be compliance on their side.

I hope that in the process, in focusing on our side, we do not skip the most important thing that I think we can all keep in mind for arms control—and I know there are many people who do not agree with SDI because they are concerned about arms control.

This Congress has an opportunity right now, today, perhaps within the next few weeks. We are at probably the most critical area in terms of arms control for our negotiations with the Soviet Union. The opportunity that the Congress has is embodied in the fiscal year 1987 supplemental for SDI as well as in the 1988 budget.

Since there has been and continues to be strong support—and I am thankful of that—for the research program, there is an opportunity for a unified message to go to the Soviet Union, that the Congress and the administration is together in such a way that they will use SDI properly as it was intended to be by the President, and that was to help change the whole strategic environment, in terms of strategy, in terms of policy, technology, and certainly in terms of arms control.

I would hope that we would not lose sight of this important opportunity in the examination of our compliance and what we are trying to do in the program.

Now, that is a personal statement. That is not a cleared administration statement. But all of us who work on the program are dedicated to changing the environment, and we consider arms control an important part of it.

I would surely hope that we make a strong enough case so that you can see that we do comply and that in the process of complying that the program is worthy of the kind of support that will send the right message to the Soviet Union.

[The prepared statement of General Abrahamson follows:]

PREPARED STATEMENT OF LT. GEN. JAMES A. ABRAHAMSON
USAF, Director, Strategic Defense Initiative Organization

Thank you Mr. Chairman for the opportunity to appear before the Strategic Forces and Nuclear Deterrence Subcommittee today. As the Administration requests funding for the fourth and fifth years of the Strategic Defense Initiative (SDI) Program, it is useful to look ahead at the challenges that remain for this very important Initiative. March 23rd of this year marked the fourth anniversary of President Reagan's decision to establish the Strategic Defense Initiative. I am pleased to report that in research and technology development, many exciting advances have taken place over these four years. As a result of their active interest and participation in the SDI Program, our nation's scientific, industrial, and academic communities have fostered some of the finest, most sophisticated technological advances of this decade.

However, while technological advances have filled us with hope and spirit of what our research might produce, we cannot ignore the fact that some aspects of this world have not changed. As was the case four years ago, and is even more apparent today, the Soviet Union is engaging in a determined, steady buildup of strategic nuclear weaponry improving their capabilities across a wide spectrum of strategic warfare. Moreover, Soviet strategic defenses are extensive and growing. The Soviet Union has the only deployed or operational anti-ballistic missile system, the only anti-satellite system, the most comprehensive air defense system and the most intensive research and develop-

ment effort in the application of new technologies to ballistic missile defense in the world today to include ground- and space-based lasers, particle beams and microwave weapons, interceptors, heavy lift space transportation vehicles, tracking and surveillance systems. The President has charged the Department of Defense with defining real options for using defense to counter the Soviet progress in improving strategic offensive and defensive forces. The SDI provides a hedge against the real potential for Soviet efforts to exploit emerging ballistic missile defense technologies and possible breakout from the ABM Treaty.

The essence of the SDI Program, as directed by the President is to provide effective defense options for a future decision to develop and deploy ballistic missile defenses. Since ballistic missiles are the most capable weapons for accomplishing a disarming first strike, we are conducting research to find ways to defend against this threat, thereby providing a better basis for deterring aggression, strengthening strategic stability, and increasing the security of the United States and our allies. I must emphasize that the SDI is not a bargaining chip to be given up for arms reduction but instead is a catalyst that encourages meaningful arms reduction. Furthermore, SDI remains as defensive insurance against potential Soviet non-compliance and other threats.

Initially, the SDI Organization (SDIO) based its plan to fulfill our goals on an independent scientific assessment, the Fletcher Commission Study. We designed a vigorous, goal-oriented program designed to ensure that the

researchers have a defined target and clear knowledge of the desired capabilities. The SDIO was directed to place principal emphasis on technologies using non-nuclear kill concepts. Research on nuclear directed energy weapons is being done to develop an understanding of the potential of this technology and as a hedge against Soviet work in this area.

Despite the growing disparity between our budget requests and Congressional appropriations, we must continue to strive for a balanced program. We must provide the technologies that yield the defense capabilities needed. This requires that we pursue sensor/interceptor concepts for each phase of the ballistic missile flight, and the battle management and command, control and communications (BM/C3) capabilities to guide and manage the overall system. Balance requires not only validating technology before any decision is made to develop and deploy a defense, but also developing the technology base. Our ability to address the continually increasing Soviet capabilities rests with having a vigorous technology program that validates the feasibility of our most advanced defense concepts. Balancing these competing needs in a well-defined investment strategy is the essence of the management challenge.

To meet our goal, we have defined a basic investment strategy with three major thrusts. First, we are bringing the most mature technologies to the point that if the decision were made to proceed, the job of developing and deploying the individual system concepts would be largely one of engineering. Second, we are pursuing the development of emerging technologies that have the potential for major

improvements in defense effectiveness. And third, we are ensuring that an investment be made in innovative ideas that hold the promise of great success, although they present a higher technical risk. These innovations could yield a high payoff in achieving a thoroughly reliable defense.

Our intent has been to demonstrate technical feasibility of effective strategic defense and to provide the broadest possible range of effective defense options to the President, the Congress, and the American people. While the Congress has increased SDI funding every year, the differences between what the Administration has requested to conduct a balanced research program and what the Congress has appropriated, are so large that if this trend continues, it will have a very substantial, detrimental impact on the Program.

Large budget reductions from the FY 1985 and FY 1986 requested levels caused a reduction in the number of promising technologies being pursued in parallel and increased the difficulty of realizing adequate solutions to specific technical issues. Additional sizable reductions made in FY 1987 have placed SDIO in a position where simply scaling back alternatives is no longer viable. Specifically, some portions of the SDI Program have been slowed approximately one to two years. In light of the Soviet threat cited above, we are extremely concerned about this slowdown. To date, despite reductions in the Administration's funding requests, the SDIO is pursuing a balanced albeit delayed program in which both the technology base and technology validation efforts received equal emphasis. However, the SDIO will not

be able to maintain this essential balance if the trend of relatively large reductions to the Administration's requests continues.

We have focused on the technologies that could be used for increasing levels of defense. However, effort on some technology candidates has been either reduced or eliminated. We have retained our pursuit of innovation, but at a smaller rate of investment. There are changes, some of which may be irreversible, that have lengthened the time schedule and limited the number of capable defense options that will be available. In addition, by eliminating many higher-risk/higher payoff alternatives, the risk of not achieving our goals has increased.

PROGRESS

We have received a great deal of support from the American public and are optimistic about the prospects for a well supported and successful technical program -- one with well-defined objectives that will allow us to carry out the mission assigned to us by the President. With that support we expect to realize the revolutionary capabilities and opportunities effective defense offers. Based on progress to date, I believe our optimism about the prospects for success is warranted. Let me mention briefly some of this progress.

o We have greatly increased our confidence in the prospects for achieving a flexible, effective boost phase intercept capability. Ballistic missiles are very vulner-

able in this phase of flight because of their highly visible tail of fire as they travel through the boost phase. Boost phase intercept is particularly desirable because the missiles still hold all their deadly warheads.

o We are encouraged by enhanced prospects for success in achieving midcourse interactive discrimination. The capability to discriminate warheads from the many forms of decoys and penetration aids that the attacker can dispense to accompany the attack is essential for effective ballistic missile defense.

o We are making excellent progress in several key technologies that would facilitate the achievement of the system capabilities I just mentioned. Let me first briefly summarize these technologies.

First, we have made excellent progress with small homing hit-to-kill warheads. Their importance lies in the fact that they are of small size and volume and can be launched to high velocities either from a space platform or the ground with relatively small boosters and then maneuver to hit the target.

For ground-based lasers, advances in free electron lasers have opened the doors to initiation of a much more aggressive technical program to achieve high performance levels.

Third, dramatic advances in particle beam accelerator technologies and the validation of a technique for determin-

ing the location of the particle beam in relation to the target have encouraged major new efforts for an early space-based experiment to demonstrate interactive discrimination.

A fourth key technology that we are pursuing is multi-spectral sensors and associated signal and data processing. These systems can act as the eyes and brains of a large complex set of actions and counteractions as well as providing an unprecedented view of where things are and what they look like. In doing so, they satisfy the demands of identification, discrimination, and decision-making for individual weapons.

Over the past year, sensor technology developments continued vigorously in five areas: radar technology, IR sensors, laser sensors, interactive discrimination, and signal processing. Several specific accomplishments are worth relating. Work has progressed on the installation of a real time discrimination system. This is the first system to demonstrate real time radar imaging of ballistic missiles.

Secondly, the preliminary design for the x-band Terminal Imaging Radar was completed. This ground-based sensor will be capable of producing high-resolution images of a potential far-off target and will permit discrimination of warheads from decoys outside the atmosphere. Such radar technologies will be available for experimental validation in the late 1980s.

IR sensor performance improvements and radiation hardening are required for use by space-based surveillance and

tracking systems. A critical support technology is the cryogenic cooling needed for sensitive IR sensors. A dramatic milestone occurred this year when our primary cryocooler design successfully demonstrated a five year lifetime, proving the feasibility of an active cooler for the long wavelength infrared surveillance mission. In addition, the integrated performance demonstration of the backup cryocooler design was also successful.

ALLIED PARTICIPATION

In addition to the many technological successes I have mentioned, we have also enjoyed great success with respect to allied participation in SDI research. Allied involvement in the SDI Program is very important if we are to realize the goals of the SDI in the most efficient and timely manner. There are several areas in which allied government institutions and private firms can make substantial technical contributions resulting in lower overall program cost and improved program schedule. Last year, prime contracts were awarded to governments or private firms in the United Kingdom, the Federal Republic of Germany, Israel, Italy, and France. Belgium and the Netherlands are also subcontractors. All SDI contracts to allied firms are awarded strictly on the basis of technical merit and cost, consistent with the competitive procurement practices mandated by the Congress.

ATBM

Additionally, the SDIO, in compliance with its charter to perform research for defending against ballistic missiles

of all ranges, is participating in a number of projects already underway dealing both with the concepts for theater ballistic missile defense and with the requisite technologies. Last year, the Secretary of Defense announced the award of seven industry contracts, three to allied prime contractors and four to U.S. prime contractors, for "Theater Architecture Studies." All of the work being done by SDIO is designed to be complimentary with a variety of other efforts in this area already underway within the NATO structure and under the Army ATM Program.

ABM TREATY

There are four major points to be made regarding United States policy on compliance with the ABM Treaty. First, the SDI research program is being conducted in a manner fully consistent with all U.S. treaty obligations. The President has directed that the Program be formulated in a fully compliant manner, and the DoD has planned and reviewed the program (and will continue to do so) to ensure that it remains compliant.

Second, while the President found in October 1985 that a broader interpretation of the ABM Treaty is fully justified, he also directed that as a matter of policy the SDI Program not be restructured to take advantage of this broader interpretation of the ABM Treaty. Under the broader interpretation of the Treaty, ABM systems that are "based on other physical principles" (i.e., other than the physical principles used in 1972 in ABM interceptor missiles, ABM launch-

ers, and ABM radars) and including components capable of substituting for ABM interceptor missiles, ABM launchers, or ABM radars may be developed and tested but not deployed, regardless of their basing mode. Under the more restrictive interpretation, testing and development of ABM systems based on other physical principles are allowed, but only for fixed land-based systems and components.

Since the President decided in October 1985 as a matter of policy not to restructure the SDI Program in accordance with the broader interpretation of the ABM Treaty, all statements in this testimony regarding compliance with treaty provisions should be understood to be based on the more restrictive interpretation. The President has reserved the right to restructure the SDI Program to take full advantage of the broader bounds of the ABM Treaty.

Third, because there are areas which are not fully defined in the ABM Treaty, it is necessary in some cases to infer specific standards for compliance. Three of the more important working principles are:

o Compliance must be based on objective assessments of capabilities which support a single standard for both sides and not on subjective judgments as to intent which could lead to a double standard of compliance.

o The ABM Treaty in Article V prohibits the development, testing, and deployment of ABM systems and components that are sea-based, space-based, air-based, or

mobile land-based. However, the Treaty does not limit research and its associated testing short of field testing of a prototype ABM system or component.

o The ABM Treaty, of course, restricts only defenses against strategic ballistic missiles; it does not apply to defenses against cruise missiles or defenses against nonstrategic ballistic missiles, provided that such defenses do not have ABM capability.

The United States government must guard against permitting a double standard of compliance, under which the Soviet government could expect to violate particular provisions of arms agreements without consequence, while the U.S. continues to comply with all provisions. The United States must reserve the right to respond to Soviet violations in appropriate ways, some of which may eventually bear on Treaty constraints as they apply to the United States.

OVERALL COMPLIANCE ASSESSMENT

The SDI Program consists of near-term technology research projects and major experiments. The research projects directly support the major experiments by providing the necessary technologies. These research activities are well defined and clearly compliant. The major experiments, most of which are to be conducted in later years, are also being planned to be fully compliant. Experiments can demonstrate technical feasibility without involving ABM systems or components or devices with their capabilities. Thus, useful and compliant experiments, in both "mobile" and "fixed land based" configurations, are allowed.

As outlined in Secretary Godwin's statement, SDI projects and experiments have been reviewed to ensure that they will be conducted in accordance with one of the three categories of activities permitted by the Treaty.

The Services and SDIO are obligated to plan and implement these experiments in a compliant manner. Many of the SDI devices do not use traditional technology, but are "based on other physical principles" (such as lasers and optical sensors). In these cases, they are evaluated by considering their capability to substitute for traditional ABM components, and whether they will be "tested in an ABM mode" by analogy to the 1978 Agreed Statement, which does not address devices based on other physical principles. The entire SDI Program is compliant with the ABM Treaty and all other U.S. treaty obligations. The bulk of the near-term effort consist of technology research projects that support major experiments to be conducted by the SDI Program.

PHASED DEPLOYMENT

Possible near-term options could include the use of kinetic energy weapon and sensor systems technologies to concentrate on the early portion (boost phase) of a ballistic missile's flight trajectory, and could consist of space-based kinetic kill interceptors (high speed projectiles) combined with surveillance and targeting systems. A second, late midcourse, defensive layer of this initial phase could consist of ground-launched interceptors, combined with ground-based radars and ground-launched infra-red probes, to destroy nuclear weapons that have escaped the boost phase.

However, this cannot be the only response we have available to address this potential Soviet threat. If a defensive system is to have lasting value, technology and tactics must be available that would allow the system to evolve over an extended period to counter any plausible threat. This would ensure the system's military effectiveness, survivability, and cost effectiveness at the margin. By this we mean that the defensive system should be designed so as not to provide incentives to a potential adversary either to acquire or retain additional offensive forces in an effort to defeat or overwhelm the effectiveness of our defense. These vital requirements to system effectiveness cannot be ignored in favor of a "quick fix." Any desire to limit the scope of a strategic defense system to near-term options only would severely undermine the potential offered by comprehensive, layered defenses.

CONCLUSION

At this point, I would like to emphasize that we have remained resolute in our pursuit of the objectives set before us despite congressional refusal to fund fully the SDI budget at the requested levels. However, this goal is threatened by proposals to limit real growth to an annual three percent budget increase. Such limited funding would seriously affect the vital balance between development of a technology base and technology validation efforts essential to support a development decision. It would not allow us to keep pace with expected Soviet offensive and defensive developments. If SDI funding continues to be limited, the U.S. is not only going to waste its greatest leverage--the

innovation only possible in a free society--but it cannot expect to do more than just react to Soviet initiatives in strategic defense. If U.S. efforts to provide a thoroughly reliable defense are to be successfully carried out in a timely fashion, funding must be restored to levels that will allow the SDIO to pursue effectively options for ballistic missile defense of the U.S. and its allies.

The time has now come for the political and technical communities in our country to come together and agree upon a stable future course for the Strategic Defense Initiative Program. Our goal is both valid and appropriate, our systematic approach is sound, and our technical progress has impressed even the most severe critics.

The prospects for reaching this objective will continue to improve as our program proceeds to exploit emerging technologies. The fact that the SDI Program has already yielded impressive dividends which have met or exceeded our expectations in key program areas is testimony to the skill and enthusiasm of American and allied researchers, and, I believe, well justifies the considerable confidence of the American public, and the support of their elected Congress.

Senator EXON. General, thank you very much for your statement.

We will now get into the matter of questions.

I must leave very shortly to go to——

Senator HUMPRHEY. I'll chair.

Senator EXON. Yes, I will be happy to have you chair. I have to leave for a pretty important matter, going over to the Budget Committee on which I serve, to try to get the defense mark up considerably over what has been yet suggested. That mark will be baseline in the budget document, plus inflation.

Another way of stating that is that would be no real increase over defense for last year.

I mention this only because I think this has a chance of carrying in the Budget Committee, and from the discussions that have been held, unofficial as they are, I would simply say to you, gentlemen, and you, General, and to the Defense Department in general, that if we are successful when this process finally winds down this year, in protecting the defense budget to no real growth but no real decline—that is another way of stating it—I think we are going to be indeed fortunate from the climate that exists around here.

Now, you can all argue that that is not right, that is not fair. But when you argue that we are crippled because of Gramm-Rudman and the restraint that that places on the budget, it does, indeed, force us—it indeed does force us to make very hard decisions, and also, because over half of the budget is off-limits to cuts under the magic of Gramm-Rudman.

I would just put in a caveat right here. This Senator stood on the floor and said eventually Gramm-Rudman is going to destroy a major part of the defense buildup that we have all been a part of.

We have a mania to go one way and then we have a mania to go another.

I think it would be tragic, indeed, if we accepted some of the cuts that have been suggested.

I wanted to give you that background, General, because your testimony over the years has been excellent. I think that you have been a strong advocate of SDI. Not all of us have always agreed with you 100 percent, at least not in the funding levels. It is not because we did not want to but because we do not have the money.

MAKING PROGRAM CUTS

So I simply congratulate you once again for your presentation here this morning and say that I would like to ask you some questions for the record. What program would you cut back—and I suppose this would be classified and probably should not be discussed at this level anyway—where would you make cuts if the full increase, as requested by yourself as head of the program and the administration, is not granted? What cuts would you make and where if you do not get the full amount of money that you have requested?

What is that? Last year, with regard to the DOD budget and that part of your program that is in the energy budget, we were somewhere in the area of an expenditure, an authorization, of $3.5 billion.

Is that about right?

General ABRAHAMSON. Yes, sir. That was the sum of the two.

Senator EXON. And right now, the request before the Congress is $5.2 billion for SDI, a supplemental of several hundred thousand dollars, and a further budget for the energy part of your program that, in round figures, would take us up over $6 billion for this fiscal year.

Is that correct?

General ABRAHAMSON. Sir, it is $5.2 billion within the Department of Defense allocation and it is slightly over $500 million in the Department of Energy. So, it is $5.7 billion.

Senator EXON. And the supplemental?

General ABRAHAMSON. The supplemental is for $500 million.

But the supplemental is to make up and try to correct some of the important cuts that had to be made last year.

Senator EXON. Yes. But, General, that is the way you military people always come at these things: wherever it comes from and for whatever purpose it is going to be used.

What I am trying to establish is if you take the $5.2 billion, the raw figure that you have for SDI in the budget, and if you add on top of that $5.2 billion the $569 million for fiscal year 1988, and add on all of the Energy Department additions, for whatever reason we are going to be increasing from a total expenditure, if we accept the recommendations of the administration, from $3.5 billion last year to over $7 billion next year, is that right?

General ABRAHAMSON. Over $6 billion, sir.

Senator EXON. So, I guess what we are saying is that we are nearing a doubling of the expenditures for SDI. I must tell you very frankly that I doubt very much we are going to be able to come anywhere near that.

My time must be just about up and I will yield to Senator Humphrey in just a moment. There is one more question that I would like to ask, though, and there may be some more later that I will ask for the record, since I do have to go the Budget Committee.

In your statement, you said, among other things, with regard to the treaty, this: Third, because there are areas which are not fully defined in the ABM Treaty, it is necessary, in some cases, to infer specific standards of compliance. Then it goes on to list three.

ABM TREATY

I guess I am still not clear—and I asked the question of the previous witness—about this. I think a substantial number of us are least convinced, as I believe our chairman, Senator Nunn enunciated very well on the floor of the Senate, if the administration is not planning on breaking out of the ABM Treaty, either by an outright violation of the treaty or renouncing it or the more compatible option, to say maybe we can reinterpret this to serve our need—I would simply say why, if they are going to stick with it, as you indicate in your statement, why have they caused to be raised all of these questions by their statements, which I think serves not very well the SDI program?

General ABRAHAMSON. Sir, if I could put that into what I think is the proper perspective, it is the perspective of the events that are going on. The President did make that determination. He has also asked what I think is a reasonable question and one that has been asked by the Congress as well, and that is to examine the program and to see the cost of remaining within the narrow interpretation, so that he could balance that cost against all of the other policy issues associated with it.

So, what is going on at this point is this. The budget has been submitted under the narrow interpretation and all of the compli-

ance machinery is operating to insure that each test planned at this point and for this budget submission is under the narrow interpretation of the treaty. At the same time, there is an examination going on to see what that cost is, what the advantages might be, so that that could be weighed in terms of the policy implications, all of those. But you must have input to determine the technical advantages.

So we are going through a process. That process will result in a report to the President about the 30th of April. We have asked that one of our reports to the committee and to the Senate be delayed until that point in time so that, in fact, we can use all of the inputs and all of the efforts that we are making to provide a complete report to the President to be solid information for our report to the Congress as well, and that is the implications of the broad interpretation of the treaty.

I would assume that, sometime after that, there will be a judgment made on exactly what is the proper course of action for the Nation. I would think that this would be broader than merely the technical input to the treaty, or our technical input in terms of the program.

Those are the facts of the process that is going on at this point. It seems to me quite reasonable to want to know periodically, in fact—not merely just once, but periodically—how well the program is progressing and what the impact is in terms of the narrow interpretation of the treaty versus the legally correct interpretation of the treaty.

Senator EXON. Thank you, General.

The record will be kept open for 24 hours for additional questions by members.

I am pleased to recognize Senator Humphrey.

Senator HUMPHREY. Thank you, Mr. Chairman.

First, I have been asked by Senator Quayle to enter a statement in the record in its entirety.

Senator EXON. Without objection.

[The prepared statement of Senator Quayle follows:]

PREPARED STATEMENT OF SENATOR DAN QUAYLE

Mr. Chairman, the debate about whether we should interpret the ABM Treaty narrowly or broadly has become a lawyer's debate, a political discussion between those who seem to care more about winning their side of the argument than defending this country.

And that, Mr. Chairman, is a tragedy. Because while we're hotly debating arcane legal points in a treaty the Soviets don't honor, we're wasting real dollars, political capital and valuable time.

For an upcoming Delta 181 test, for instance, the Strategic Defense Initiative Organization decided against a "kinetic kill" experiment because it isn't allowed under a narrow interpretation of the ABM Treaty.

SDIO apparently rejected a test to see if an interceptor could hit a missile in space and, instead, scaled back the Delta 181 test to involve only mid-course and boost-phase sensors and tracking experiments.

This is just one example. There are at least 10 or more SDI tests planned for the future where the distinction between a narrow and broad interpretation of the ABM Treaty may be critical.

Under a narrow interpretation, these tests will give us some information. The questions, though, are how much and how soon? How much will these tests realistically tell us, and how long will we have to wait to see if SDI will work?

Under a broad interpretation, these tests can be done under realistic conditions against realistic threats. They'll give us some idea of what SDI might offer us in the future and tell us a lot more a lot sooner.

I'd like to emphasize again. This is not an academic debate. Limiting the scope of our SDI tests, as we have so far under a narrow interpretation of the ABM Treaty, is costing us research money and wasting valuable time.

Mr. Chairman, realistic tests will give us realistic results. Every day we stay within the narrow limits of the treaty, it costs us more and moves the SDI program farther into the future.

Senator HUMPHREY. Thank you.

Let me just read a passage or two from it, if I may.

ABM TREATY INTERPRETATION

Mr. Chairman, the debate about whether we should interpret the ABM Treaty narrowly or broadly has become a lawyers' debate, a political discussion between those who seem to care more about winning their side of the argument than defending this country.

The balance, as directed by the chairman, has been entered into the record.

I would certainly second that analysis by Senator Quayle. Indeed, I made a statement to that effect before the joint hearing of the Foreign Relations and the Judiciary Committees last week.

In my view, the lawyers and the diplomats and the politicians are chasing their tails in trying to finally define the murky terms of the ABM Treaty. Meanwhile, while we are running around in circles, playing a wonderful academic game, the Soviets are proceeding in a straight line toward breakout from the ABM Treaty in the early 1990s, in my opinion.

I believe that Senator Quayle's argument is right on target. I happen to believe that the President's point of view with regard to interpretation is correct. But I also happen to believe that we are all wasting our time by focusing our energies on a subsidiary effort when, in fact, we ought to be primarily worried about defending the country and deploying an ABM system that, for the first time, will permit us to defend the country with true defenses, as opposed to the ghastly threat of nuclear retaliation under the mad doctrine of MAD.

Now, General Abrahamson, in reading your testimony, a couple of questions come to mind.

First, you say on the first page of your prepared remarks that the Soviet Union has the only deployed operational ABM system, et cetera, and the most intensive research and development effort in the application of the new technologies to ballistic missile defense.

With regard to their intensive research and development, are those efforts—well, let's strike research, but let's say development, their most intensive development effort, with regard to their development efforts, are they fully in compliance with the ABM Treaty, as we are?

General ABRAHAMSON. Sir, I don't think that we can know that. I do not believe that there are verification methods that are available to us at all to be able to understand fully all of their test programs that would allow us to make that judgment.

Senator HUMPHREY. So, then, in effect we are relying upon Soviet goodwill and good intentions.

General ABRAHAMSON. I think that is correct, sir.

DEPLOYMENT OF ABM SYSTEM

Senator HUMPHREY. What about deployment?

The treaty makes clear that no type of ABM system, beyond the one system permitted each side, can be deployed, at least without consultation—even systems involving OPP.

In your opinion, are the Soviets fully in compliance with the narrow interpretation of the treaty with regard to deploying components of an ABM system?

General ABRAHAMSON. I do not think the question is the narrow or the broad interpretation of the treaty for deployment. It is quite clear that they are already in violation of the fundamental treaty itself, and that report has been presented to the Congress. The radar at Krasnoyarsk is one of the unambiguous areas of the treaty and in deployment it has been judged, quite clearly, that they are in violation.

Senator HUMPHREY. We often hear the word "breakout." It is sort of a specter—"breakout."

I am not sure that we are prepared to recognize a breakout when we see it, unless it is a massive, wholesale, full spectrum breakout. Apparently, we are willing to avert our gaze if it is a partial breakout. It is sort of the "salami" technique applied to breakouts, if you will, that if they slice off a little piece of breakout, we are not prepared to recognize that as a breakout.

KRASNOYARSK RADAR

Do you view the deployment of the radar components, that is, the Krasnoyarsk management radars, as a breakout?

General ABRAHAMSON. Well, the deployment of the Krasnoyarsk radar all by itself is a violation.

The building of the entire radar system that they have put into place and continue to build on, while it may be within the strict legal interpretation of the deployment aspects of the treaty, what it does do is it provides them the command and control system, the surveillance system; so that, if they chose to—and I don't know, and cannot speculate on that—but if they chose to, they could quite easily do exactly what you said. They could break out in a way that would be very apparent to us or they could quietly, in fact, begin to build a capability that would be very difficult for us to detect.

Senator HUMPHREY. How many of the Krasnoyarsk radars have we identified now, either fully constructed or under construction?

General ABRAHAMSON. I will have to get that count. I believe it is something on the order of eight.

There are three new ones that we recently were able to find up in the northeast border. Now, within the terms of the treaty, they are properly placed, facing outward and on the border of the nation. But it is evidence of their very strong effort and their tremendous expenditure to continue to build that system and to make it fully capable.

Senator HUMPHREY. Well, how many of those Krasnoyarsk types are constructed on a site such that they are unambiguously violations of the treaty?

General ABRAHAMSON. Only the one at Krasnoyarsk, sir.

Senator HUMPHREY. Well, does that constitute a breakout?

General ABRAHAMSON. No, sir. It constitutes a violation of the treaty.

Senator HUMPHREY. Well, define "breakout" for me.

Is "breakout" a fully deployed ABM system with all components? I mean, do we wait until it is all there, every last bolt is turned, every last switch is thrown, before we say "breakout?"

I mean, what is a breakout?

General ABRAHAMSON. I think you have put your finger on a very important question. By putting in place the surveillance capability, then, by merely deploying incrementally and in small ways the weapons that go with those, they could, in fact, achieve a significant capability.

Now, when and how you call that "breakout" or "sneakout" is not a defined term. I think you have put your finger on a key point.

Senator HUMPHREY. I think we ought to define it. Breakout is something more. We should not wait to consider it a breakout until every last component, every last system, and every last installation is completed, should we?

General ABRAHAMSON. From a military point of view and the national security point of view, I have to agree with you, sir. Absolutely.

Senator HUMPHREY. Well, how much of a totally functioning ABM system would you say the Soviets have in place now, just by virtue of these radars?

General ABRAHAMSON. Well, all of the radars that they are building are not operational.

Senator HUMPHREY. OK. By what date will they be operational—roughly?

General ABRAHAMSON. I would have to check. I am not sure what we can say in an unclassified forum. But I believe that there are projections that within the next few years, several of those will be capable.

Senator HUMPHREY. Well, if they had the radar element completed, the radar component completed, that would be what, about one-third, roughly one-third, of an AMB system?

General ABRAHAMSON. Well, frankly, it is the toughest part.

Senator HUMPHREY. The toughest part.

General ABRAHAMSON. It is what we call often the longest pole in the tent. That is the most difficult pole.

Senator HUMPHREY. It says here (indicating) that my time has expired.

BUDGET REQUEST

Senator LEVIN [presiding]. General, first let me ask you about your budget request.

I understand from your testimony that your budget request for 1988 and 1989 assumes compliance with the narrow interpretation of the ABM Treaty.

General ABRAHAMSON. It was assembled that way and that is the way it is being submitted. Yes, sir.

Senator LEVIN. The timetable for a Presidential decision as to whether to remain within that narrow interpretation is what? Is it the end of April?

General ABRAHAMSON. Our reports are due to go to the President, both the programmatic reports that I am to submit as well as some of the additional examinations of the legal interpretations, at the end of April. What the timetable for a decision might be after that I do not know.

Senator LEVIN. We have to mark up this budget, or we are hoping to mark up this budget, at least at the subcommittee level, prior to the end of April. So we would be in a position of having to mark up a budget without knowing what the Presidential decision is.

Are you going to inform us of what your recommendation to the President is so that we can act on at least that knowledge, or are you going to retain that information to yourself and the President and not disclose it to us?

General ABRAHAMSON. The report to the President obviously is a report on which he has to make a judgment as to how it will be handled.

I have an additional legal requirement to report to you much of the same information that will be in that report.

Senator LEVIN. And that is by the end of April?

General ABRAHAMSON. We have asked for a continuance of the timing for that so that we can have essentially the same quality of information available for that report as we are providing to the administration for their consideration.

Senator LEVIN. That continuation would be until the end of April?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. That would then make it impossible for us to have your conclusions prior to markup.

That leaves us, in effect, writing a check for your projects in the dark, without knowing whether we would be contributing to what we—or I should say many of us, and not we—consider to be a violation of the traditional interpretation of the ABM Treaty.

My question to you is is it possible for you to give us your conclusions by April 15?

General ABRAHAMSON. I will have to go back and examine that, sir, and give you that information.

Senator LEVIN. Thank you.

SDI DEPLOYMENT

Has it been decided by anybody in the administration that the first phases of SDI deployment will have to meet the Nitze criteria concerning, among other things, cost effectiveness at the margin and survivability before those phases are approved?

General ABRAHAMSON. As I indicated in testimony, the closed testimony before the committee, first of all, there has not been a policy decision about a phased deployment yet at this point in time.

What we have done is try to lay out what a phased deployment might naturally look like in terms of its characteristic and its architecture.

The actual, final judgments about that will probably come out of the DAB process that Mr. Godwin talked about and that was included in his testimony, about how robust should such a first system be.

The policy question of what criteria that has to meet has not been faced. However, in your own committee report, which I think is a very effective kind of criteria that has been laid out, the committee talked about strategic defenses that must be survivable. In my closed testimony, I presented information on why I think it can be made survivable.

Senator LEVIN. General, could you answer my question. My question is has it been decided yet whether the Nitze criteria would apply, assuming the policy decision to proceed in phases is made?

General ABRAHAMSON. I am not aware of a final decision.

Senator LEVIN. Relative to that?

General ABRAHAMSON. Relative to that. At least, I have not seen a written directive that would offer that kind of final decision.

But I believe that the reason for that is because the policy question has not been addressed.

Senator LEVIN. Without getting into the reasons, as far as you know, that decision has not been made?

General ABRAHAMSON. I am not aware of it personally. No, sir.

NSDD 261

Senator LEVIN. Are you familiar with NSDD 261?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. As far as you are concerned, then, that decision has not been made, for that NSDD?

General ABRAHAMSON. What that NSDD outlines is exactly the cost effectiveness at the margin for an overall system.

Now, how that might be applied for a first phase of deployment, I personally believe is a decision that has to be laid out or commented on. I am not aware that that decision has been made.

Senator LEVIN. Is it fair to say that the decision, relative to the applicability of the Nitze criteria to any phased-in process has not been made? As far as you are concerned, it has not been made?

General ABRAHAMSON. That is correct.

Senator LEVIN. OK. Thank you.

General ABRAHAMSON. I would like to point out that we are continuing to work in exactly that way, however. I think that is very vital. So, should it be made, we will be in a position to point out and show just how, indeed, that can be applied.

Senator LEVIN. Thank you.

General, have you concluded that a space-based kinetic kill vehicle experiment is based on other physical principles?

General ABRAHAMSON. The answer is no, sir.

Senator LEVIN. Relative to a question which Senator—excuse me. I see that my time is up.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

General Abrahamson, let me take Senator Levin's questioning a step further.

PROGRAM SURVIVABILITY AND COST EFFECTIVENESS

You seemed about to elaborate on the fact that the conduct of the program that you have been in charge of has been conducted in order to meet the criteria of survivability and cost effectiveness. Is that correct?

General ABRAHAMSON. That is correct, sir.

Senator WILSON. All right.

I was going to ask you whether or not you concurred in Ambassador Nitze's recent assessment that a survivable and cost effective defense against ballistic missiles has yet to be identified.

General ABRAHAMSON. Oh, frankly, I do not agree with that.

I think that the architectures that we have laid out show us that, as the research program is maturing, in fact the issue of having a system that penalizes the attacker, as opposed to penalizing us, in terms of the confidence level that they would have, which is a way of stating cost effectiveness at the margin, is really quite possible.

This does not mean we have achieved every element of it. We are not in that position yet. But we are moving and gaining confidence that yes, that can be achieved.

Senator WILSON. So you have been applying those standards to your work?

General ABRAHAMSON. Yes, sir. I have been.

Senator WILSON. Does the Office of Special Arms Control Advisor have any independent cost or survivability analysis capability?

General ABRAHAMSON. I am not aware of such a capability, sir.

Senator WILSON.Is it possible that he has some information about your program that you do not have?

General ABRAHAMSON. No. We try to keep everybody as informed as possible.

Senator WILSON. That was my next question.

Is it possible that you have information that he does not have?

General ABRAHAMSON. I think yes, indeed. I have a great deal more information.

Senator WILSON. Let me make a suggestion to you, that you share it with him at the earliest mutually convenient date.

General, let me ask you this.

SPACE-BASED KKV

Is the space-based KKV a space-based version of ERIS?

General ABRAHAMSON. Let me answer you technically.

There are components and subcomponents in it that are similar to ERIS, but there are some very significant differences as well.

If you are asking that question, sir, within the context of the treaty, the treaty requires, I think, some legal interpretation about how these things fit into that overall system.

There are very significant differences.

ERIS is guided by radar into a box, where it is close enough that then the infrared or the other physical principle components can take it on and it can impact a warhead on the way in.

The space-based interceptor, as presently envisioned, does get one early update, but relies on its own ability and self-contained guidance capability to go the great distance to the point where it can, indeed, strike a booster on the way up.

So, there are some similarities and some important differences.

This has to be put into the context of the treaty, and this I have not done yet.

Senator WILSON. So, the sensor guidance for the weapon system is based on a technology that is based on other physical principles?

General ABRAHAMSON. I think it is quite clear that, in fact, the optical systems were not talked about in the treaty under the category of the traditional systems.

Senator WILSON. Let me ask some questions that I have asked in closed session simply because I think they ought to be asked in open and the answers recorded.

U.S. DEFENSE AGAINST BALLISTIC MISSILES

If unconstrained by any constraints, other than technology, can the United States, in your judgment, deploy a defense against ballistic missiles in the mid-1990s that is both survivable and cost effective?

General ABRAHAMSON. I believe the answer is yes, sir.

Senator WILSON. Could you give us a ballpark figure as to what it would cost to deploy such a system?

Would it be about $50 billion?

General ABRAHAMSON. We have a specific architecture that is being used as a straw man for our first look at what a sensible Phase I deployment might be, and using the cost estimating relationships that we know of today, it is in that ballpark. Yes, sir.

I must point out that this needs to be validated from a military point of view by the JCS, and they may, in fact, want to increase it or may accept something lower. But, in addition to that, we also have some very important cost reduction research programs going on, which may, indeed, lower that cost.

Senator WILSON. And the statements of some others, the Union of Concerned Scientists and others, that this system would cost $1 trillion have no basis in your experience with respect to the system that you are describing?

General ABRAHAMSON. Certainly not for a Phase I. And I have said repeatedly in testimony that those kinds of cost estimates are in fact based on their judgment of what a system might look like and using cost estimating relationships some of which I do not even understand. And some of their judgments about what a system might look like have clearly been in error, and they have even written to the various committees and admitted some of those errors.

So I believe that there is no basis in fact for a reasonable trillion dollar system. Perhaps more important than all of that, I have stressed time and time again that this must be an affordable option for the Nation. My own motivation, my direction, everything, is to find an affordable option. A trillion dollars I do not think is in the affordable category.

Senator WILSON. Let's come back now to your roughly $50 billion Phase I system, the first generation.

Would not such a system be capable of negating Soviet attacks that would include several thousand ballistic missile warheads?

General ABRAHAMSON. Our best judgment is now yes, sir.

Senator WILSON. Was phased deployment of the Strategic Defense Initiative recommended by the President's original future security strategy study in 1983?

General ABRAHAMSON. Yes, sir.

Senator WILSON. The so-called Hoffman Panel?

General ABRAHAMSON. Yes, sir.

Senator WILSON. Would it be fair to say that a phased deployment strategy has consistently been in your field of view from the outset of this program?

General ABRAHAMSON. The answer is yes, sir. If I could, I would like to put up two charts that I have shown the committee in closed testimony. But, more important than that, I have shown it in past years in open testimony.

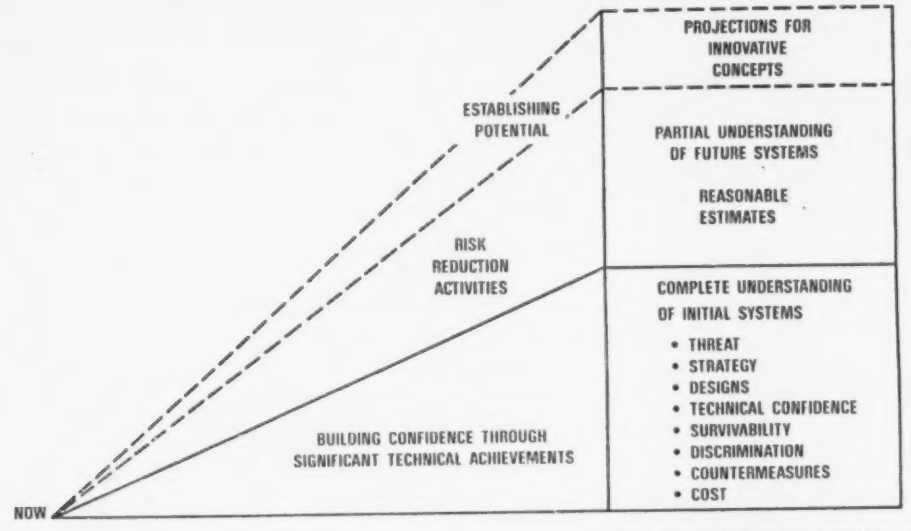
STRATEGIC DEFENSE INITIATIVE BUDGET REQUIREMENTS FOR FY1987–FY1989
($ IN MILLIONS)

PROGRAM ELEMENT	FY87 (CURRENT)	FY87 (SUPPLEMENTAL)	FY88 (BUDGET)	FY89 (BUDGET)
SURVEILLANCE, ACQUISITION, TRACKING & KILL ASSESSMENT	911.0	70.0	1,492.7	1,859.5
DIRECTED ENERGY WEAPONS	844.0	70.0	1,103.7	1,245.8
KINETIC ENERGY WEAPONS	730.0	60.0	1,074.7	1,199.7
SYSTEMS ANALYSIS & BATTLE MANAGEMENT	387.0	40.0	627.3	787.5
SURVIVABILITY LETHALITY AND KEY TECHNOLOGIES	338.0	260.0	900.4	1,162.2
MANAGEMENT HEADQUARTERS (SDI)	19.9		22.0	27.3
TOTAL	3,229.9	500.0	5,220.8	6,282.0

The first one is a chart that we put together trying to explain the content of the fiscal year 1985 budget. In that particular chart, you see on the left are those times of budget requests. We tried to lay that out in such a way that we divided the budget request into mature technologies, which would be there for an initial partial capability; for advanced technologies, which would be more countermeasure resistant and more cost effective; and, finally, for innovative technologies for the future.

So those were charts that I used back in 1985, to try to explain that the natural, reasonable way for research to mature, to go through development and finally into deployment, is phasing.

DEVELOPMENT DECISION CONTENT



I went a step further than that and I laid out what I thought would be a reasonable development decision content. Now, obviously, this is the content of this national decision that has been talked about prior to deployment, and what you see on the lower right-hand corner is what I felt at the time would be quite reasonable to expect in terms of the information that we would provide, certainly any administration, but also any Congress, in making that decision. That is a very complete understanding of the first initial deployment system.

But there is an important relationship between the first one and your ability to bring on board the follow-on steps. So I felt that, when you make that first decision, you would want to have at least partial understanding of many of those same factors for your follow-on, and you would like to have some confidence that there are avenues of research that are going to take you to the President's final, important goal, even if they are a long time away.

So, therefore, I think that I have addressed both aspects of this, both phased deployment as a concept and how I felt the decision could or should be made.

This chart is also a 1985 chart.

Senator WILSON. Thank you, General. My time has expired. I will have other questions.

Thank you, Mr. Chairman.

Senator LEVIN. Senator Thurmond.

Senator THURMOND. Thank you very much, Mr. Chairman.

General Abrahamson, we are glad to have you back with us.

General ABRAHAMSON. Thank you, sir.

BOOST SURVEILLANCE AND TRACKING SATELLITE

Senator THURMOND. You have testified previously that under the narrow interpretation, you will commit to the launch of a boost surveillance and tracking satellite in the early 1990s that is only partially capable. What is the implication of this approach in terms of the cost, schedule, and degree of confidence that you have in the research program?

General ABRAHAMSON. What it will mean, sir, is that we will build a very expensive satellite, launch that into orbit for the purpose of testing, in order to see whether such a system is feasible. It will take, then, a second and third launch later on of a fully capable system to begin to contribute and be ready for both development and deployment.

The real implication is that we are building an extra-expensive satellite for test purposes alone.

With a broader interpretation of the treaty, we may be able to direct people's efforts now, is such a way, that the satellite might be more fully capable.

Senator THURMOND. General Abrahamson, can the contracts for the BSTS be restructured down the road to recover the costs, schedule delay, and confidence lost in the more restrictive approach?

General ABRAHAMSON. The answer is that yes, we can restructure the contracts later on, sir. But the longer one waits for that restructuring, the more design effort and test effort has been wasted, and the implications are that it will cause additional costs—costs will go up—as well as additional time to recover, to put the more fully capable satellite in place.

Senator THURMOND. General Abrahamson, what effect would reductions in fiscal year 1988 and fiscal year 1989 budget requests for SDI to fiscal year 1987 levels have on both the timing of a decision to proceed to develop and deploy a strategic defense system and on the level of confidence you would have in technically supporting such a decision?

General ABRAHAMSON. Sir, it would have a dramatic effect. We had major cutbacks last year.

The way I tried to absorb those cutbacks was to slip some elements of the program, but in some cases to make decisions between what were competing technologies to accomplish some of the same ends.

You can only do that once. You can make competing decisions once. But once you have rejected one, then all of your horses are on the one that you have selected.

We do not have that option, and it would have a dramatic effect.

First, it would disjoint the program.

Second, it would slow us down very, very dramatically.

Third, I believe it would have another effect that is a very vital one, that industry itself is investing a large number of their funds, and they are putting their best people on this project. When they see that we plan a project but then are unable to carry it out and

that we have to terminate a project or stop a proposal process, a selection process, the best people will say they want to go work on something else that is more stable, and industry will not contribute its share of the money to the project.

So there are three very dramatic and very debilitating effects.

HEAVY LIFT LAUNCH VEHICLE

Senator THURMOND. General Abrahamson, how does congressional action on the supplemental request for the heavy lift launch vehicle affect our earliest options to develop and deploy a strategic defense system?

General ABRAHAMSON. The timing of a heavy lift launch vehicle is such, the development is such, that if we start now, we may be able to have a partial capability by about the mid 1990s.

Now, the Nation needs that far more than SDI. However, SDI needs it in order to be able even to have the option to deploy at a reasonable cost level.

So, if we do not proceed, we will not only deprive NASA and the other security programs in the Department of Defense of their ability to cut costs and to have a new and a very important national capability to go into space, but, further, we will be depriving ourselves of the most important cost saving element in an SDI deployment program. This is the enabling technology to bring down the cost to allow us to put survivability into the various satellites in space.

So it is the single most important element, and I believe that if we are going to reserve that capability at all, we must proceed.

Furthermore, by not acting now, I think we are sending, again, a very important signal to the Russians, and that is that we intend to allow them to be the only nation in the world, within just a very few years, to have a heavy lift launch capability for whatever purpose they choose to use—military or scientific.

Senator THURMOND. General Abrahamson, the SDI program has been criticized by some for either slowing or ignoring technologies with near-term applications.

Have any options been considered and rejected that would provide strategic defense capabilities earlier than the space-based kinetic kill vehicles and the ERIS programs?

If there were such options, what was the basis for their rejection?

General ABRAHAMSON. There have been proposals, some of which I think were unduly optimistic, in terms of near-term capabilities. We have evaluated each of those and feel that they either should proceed at a slower pace, until they prove their merit, or that they do not contribute sufficiently in the long-term and they have been rejected.

But I do not think that near-term options have been rejected only for the purpose of funding. Where they have been rejected, it has been the combination of restricted funding and the potential of the concept.

Senator THURMOND. Thank you very much, General Abrahamson.

Mr. Chairman, thank you. My time is up.

Senator LEVIN. Thank you, Senator Thurmond.

Senator Quayle.

Senator QUAYLE. Thank you, Mr. Chairman.

KKV SYSTEM

General, does the KKV system need a radar to guide the KKV interceptor sensor in close proximity to its targets, as is the case with ERIS?

General ABRAHAMSON. No, sir. It does not.

Senator QUAYLE. Does the KKV system use——

Senator THURMOND. Excuse me, but would you give me 3 seconds to put a paper in the record.

Senator QUAYLE. Yes, sure.

Senator THURMOND. Mr. Chairman, I ask unanimous consent that my opening statement be placed in the record, following the other opening statements.

Senator LEVIN. It is so ordered.

Senator QUAYLE. I ask that that request not interfere with this line of questioning, Mr. Chairman.

Senator LEVIN. So ordered.

Senator QUAYLE. Does the KKV system use SSTS and BSTS IR systems in place of radars?

General ABRAHAMSON. Yes, sir. It does.

It needs initial targeting information to know that an attack has been launched and to be able to predict accurately where those missiles will be.

Senator QUAYLE. But instead of radars, we are using the SSTS and the BSTS?

General ABRAHAMSON. Yes, sir.

Senator QUAYLE. Are the KKV systems' IR sensors then a substitute for a radar?

Would it be a substitute for radar?

General ABRAHAMSON. It provides the guidance that on earlier missiles was provided by radar. Yes, sir. But it is a different approach.

Senator QUAYLE. Therefore these systems, the IR sensors, then would be a substitute for radar, radar which is defined as a component under Article II, whereas the IR sensors in the ERIS system are only an adjunct in the system radar—is that correct?

General ABRAHAMSON. The IR systems or the satellite systems which provide the surveillance information, the BSTS and SSTS I believe are the most appropriate analogue to the radar in the traditional sense, as opposed to the infrared for the guidance. I think that should be considered a subcomponent.

Now, that subcomponent, as I indicated earlier, is different than the radars which were used in the missiles themselves.

Senator QUAYLE. We get into definitional purposes, here, and unfortunately we have to do this because we have gotten into others in the legal discussion. Unfortunately, the legal discussion has become paramount to whether we ought to be doing this for national security or not.

Under the ERIS system, that IR sensor could be considered and would be considered an adjunct, is that correct? Or would that be a component? Or do you need help?

General ABRAHAMSON. It depends on the definition of "adjunct."

I believe that if one were to contrast the technology that was described in the treaty that existed back in 1972, what we had were missiles that did not have the capability to seek out with their own——

Senator QUAYLE. Excuse me. Let me tell you what I am trying to establish here.

Is there a different definition of what the IR sensors on a KKV vehicle would be as compared to the IR sensors that would be on an ERIS system—one being a component and the other being an adjunct?

What you are going to find out is quite an important point.

General ABRAHAMSON. Yes, sir. I understand that.

Senator QUAYLE. If you cannot give me the answer, I would hope that somebody could.

General ABRAHAMSON. I would like to come back on that because what I have to understand or come to a conclusion on here is the meaning of "adjunct," just what that means.

I think the important element that you are driving to is that in the old interceptors that were radar guided, the radar guidance came from systems on the ground. The radar picked out the incoming warhead. It also picked out the position of the interceptor, and it said "make a correction," so that it can get close enough so that a nuclear warhead could explode and destroy the incoming warhead.

Now, if you wanted to make an analogue to the ERIS system, the ERIS system, even though it uses an IR system on board, does require radar to get it to a box, close enough so that then the infrared or subcomponent guidance in the missile takes it the rest of the way in to strike the warhead.

The SBKKV is different than that. The SBKKV gets initial locations of where to go from the BSTS satellite. Those initial locations really tell it to go out to a particular location. It gets a very, very small update, just to say that everything is still OK. And then it goes on to its own location on its own internal guidance system.

There is an infrared sensor on the front of that system, just as there is an infrared sensor on the ERIS itself. But the infrared sensor guides it the whole distance of the flight. It does not get information from the BSTS satellite or from an external source after just this very initial update, which then takes it to the target and guides it to the target.

Senator QUAYLE. But under the ERIS, the sensors are, in effect, adjuncts—are they not—to help the radar do the job? Can I phrase it that way? Is that not correct?

General ABRAHAMSON. Yes, sir, in the sense that they take over in the final phase and guide the missile just in that last final phase.

Senator QUAYLE. In conjunction with the radar, on ERIS?

General ABRAHAMSON. But they require radar. Yes.

Senator QUAYLE. Now, on the KKV IR, the sensors substitute for the radar and do the job entirely.

General ABRAHAMSON. Yes, sir. That is correct.

Senator QUAYLE. So that is a fairly significant difference, is it not?

General ABRAHAMSON. In terms of the functioning of the system, yes, sir.

Senator QUAYLE. Well, I look forward to see what you say as far as "adjunct" versus "component." As I said, I do not particularly enjoy this discussion and I wish we would not have to spend that much time on it. But we are going to have to.

We have gotten into this, and it has become very important to this committee, to the Congress. As I said earlier, 62 of us are lawyers here and perhaps that is the reason we get into this stuff. I guess we like it.

I never liked practicing law very much and never did it too much, quite frankly. But I am going to have to do a lot more than I ever thought having come to the Senate. So we will have to put on our legal hats and sit down and get down into the trenches. But you are going to have to help us out with some of these definitions. It is going to turn out to be an important definition, what an adjunct is versus a component.

I hate to tell you that, but that is an important thing. You are not a lawyer, but you have a battery of them over there, and they are going to have to help us out.

Thank you, Mr. Chairman.

Senator LEVIN. We have 10 minutes left, so that is 2 minutes each for a second round, if that is agreeable with everybody.

General, you are going to have to help me through this, now.

As I understand your testimony this morning, you would agree to the following—and tell me if I am wrong. Unless a space-based kinetic kill vehicle and its components are based on other physical principles, you cannot test or develop them, even under the broad interpretation.

General ABRAHAMSON. No, sir. I think that you may be inferring more than I intended.

Senator LEVIN. All right.

Is the definition of "other physical principles" a policy decision?

General ABRAHAMSON. I'm sorry?

Senator LEVIN. Is the definition of "other physical principles" a policy decision?

General ABRAHAMSON. Yes, sir.

Senator LEVIN. Has it been made yet?

General ABRAHAMSON. No, sir.

Senator LEVIN. You don't make it?

General ABRAHAMSON. That's correct, sir.

Senator LEVIN. And your list is due before it is made?

General ABRAHAMSON. On the tests that we are planning—yes, sir.

Senator LEVIN. How can you submit that list without the policy guidance on that critical issue which affects what is on your list?

General ABRAHAMSON. Because that list has been submitted under the concept or under the policy decision that the test program must be carried out under the narrow interpretation of the treaty.

Senator LEVIN. No. I mean the new list that is going to be submitted to the President as to what tests could be carried out under the broad interpretation. You are submitting that list by the end of April.

General ABRAHAMSON. Oh, now I see what you are asking.

Senator LEVIN. How can you possibly submit that list when you do not have the policy guidance of what is meant by "other physical principles?" That is my question.

General ABRAHAMSON. It is a fundamental problem. It is a difficult one. What it says is that the process of making those judgments has to be made quickly. They are being worked on, and, frankly, like everything else in this program, our technical ability to go ahead and to either plan or conduct the program is impeded more by policy than by technology. This is exactly the case in this one.

We need some kind of judgment.

The other way I might have to do it is to propose two lists.

Senator LEVIN. Have you decided which way to do it?

General ABRAHAMSON. No, sir. We are still struggling with that.

Senator LEVIN. All right. Thank you.

Let me say that we are going to take 2 minutes each. I think Senator Humphrey is next. I am going by memory on this one. Let me say that we have to be out of here at 20 minutes to the hour, sharp.

Senator HUMPHREY. OK. Don't waste time.

HOMING OVERLAY

General Abrahamson, that homing overlay, was that Delta 180?

General ABRAHAMSON. No, sir. Those were two different experiments.

The homing overlay experiment was one that was conducted way back in June 1984. That was a predecessor to the ERIS concept. That was judged to be well within—and by the way, this whole issue at that point, just was not there.

Senator HUMPHREY. I know, I know.

General ABRAHAMSON. Delta 180 was the test that was conducted on the 5th of September.

Senator HUMPHREY. So 181 is the one coming up next?

General ABRAHAMSON. Now, 181 is the way we refer to a test that we are planning, and now it has slipped slightly to the beginning of January.

Senator HUMPHREY. How much more is that costing us, 181, to remain within the narrow limits, as opposed to doing what we really would like to do?

General ABRAHAMSON. The original concept for the test did include an intercept. That intercept, if it were restored, saves us, again, another launch, and allows us to move ahead more quickly with the test program.

The longer that decision goes, the less likely we are able to make a decision of putting that on.

One cost estimate is that to conduct a separate test of all of those activities that we might have had had we had the ability to go ahead and conduct that program, as we initially planned, was about $250 million.

That is one estimate, and it is a very rough estimate.

Senator HUMPHREY. Do you know of any examples of the Soviets gerry-rigging their development in that fashion, the way we have?

General ABRAHAMSON. No, sir.

Senator HUMPHREY. For tests?

General ABRAHAMSON. No, sir.

Senator HUMPHREY. You say in your statement that SDI provides a hedge against the real potential of Soviet efforts to exploit burgeoning technologies. I hope that our effort is designed as more than a hedge. I hope that it is designed to move toward deployment.

Is it?

General ABRAHAMSON. The President last summer reaffirmed that his intention is that the research program is to be built in such a way, in fact, that it goes to development and deployment. And yes, that is the way it has always been conceived, right from the very start.

Senator HUMPHREY. Why do you make the statement that it is a hedge?

General ABRAHAMSON. Because that is an additional capability and my direction says that I have an additional responsibility to define whatever might be possible in case the Soviets broke out, and whoever was responsible for determining a reaction to that, that they could look to a defensive reaction as well as other reactions that they might choose to undertake.

So that should be considered an additional responsibility of the job. It is not the primary one.

Senator HUMPHREY. My time is up.

Senator LEVIN. Thank you, Senator Humphrey.

Senator Wilson.

Senator WILSON. Thank you, Mr. Chairman.

General, I will ask you just one question.

ANTIBALLISTIC MISSILE DEFENSE

As you pursue the goal of developing for the United States an antiballistic missile defense that is both survivable and cost effective, would you state in order of magnitude the constraints which you deem to be the most important constraints upon you in pursuit of that goal. Is it dollars? Is it technology? Or is the legal constraints imposed by treaties and by the Congress?

General ABRAHAMSON. The first and foremost constraint is dollars. We have bright people out there who can solve this problem, and with enough money and enough effort we can solve it. There is no question there in my mind.

The second constraint is a constraint not only on our time and everybody else's, but certainly it is a constraint on logical testing and a logical way to proceed, and that is the various political and legal constraints on the program.

The least constraining factor of all is technology.

Senator WILSON. Mr. Chairman, I will simply take the balance of my time to state that I think that answer is one that deserves some attention.

Senator Quayle said it is important that we get into some of these legal distinctions. It is also important, I think perhaps more important, that we retain a perspective and consider well whether or not we should allow the national security to be prejudiced by a

lawyer's entertainment, and, instead, focus on that, make our agenda the security of the Nation.

Senator LEVIN. Senator Quayle, did you want to wrap up here today?

NEAR-TERM DEPLOYMENT REPORT

Senator QUAYLE. I just want to remind the General about the report, section 215, near-term deployment.

I know you are working hard on it.

General ABRAHAMSON. Yes, sir.

Senator QUAYLE. You have been working hard for a number of months. Also, you have to report back, I think it was Senator Wallop's amendment, on the difference of what you can do under the broad and the narrow interpretations.

We look forward to those reports some day, General. We think they are quite important. As soon as you can get them up here, let me say that late is better than never. Of course, never would be worse than late.

This is how I would wrap it up, Mr. Chairman, by trying to beg, once again, that those folks over there work on this and come up with a good report.

General ABRAHAMSON. Sir, we have the report.

Senator QUAYLE. We don't want you to rush through the job and give us a bad report. We want a good one. But time is awasting on this.

I would just remind the General, lightly, once again, since I have his undivided attention, as well as the microphone.

Senator LEVIN. You had the microphone. Your time is up.

Senator Warner.

Senator WARNER. Thank you, Mr. Chairman.

Mr. Chairman, I know the General is fully aware of the importance of this program to the progress that hopefully will be made in Geneva in the arms control talks. There is no single item on that agenda of greater significance to the Soviets than this particular program.

I think our President has thus far taken the right posture. I am hopeful that the President and the Congress can reach an understanding that will permit those arms control talks to go forward in such a manner that we can, hopefully, get a fair, equitable, and fully verifiable agreement on some portions of the issues now under discussion.

Thank you for your participation. I feel, as we meet almost on a biweekly basis on this program, that you have discharged yourself very well. Perhaps you will qualify for an international law degree when this program is finished.

Thank you, Mr. Chairman.

SECURITY OF THE UNITED STATES

Senator LEVIN. Senator Wilson made a comment with which I think most of us would concur. The security of this Nation is the work of this committee. The U.S. Senate, with but two dissenters back in 1972, felt that the ABM Treaty contributed to the security of this Nation. Maybe that could be called a "lawyer's entertain-

ment," or some other description. But that treaty, which was ratified with the approval of this Senate, is something which at least the Senate at that time felt, and I believe most of us at this time feel, contributed to the security of this Nation.

So I think what is involved here is a lot more than just a question over legalisms. It is a question of the security of this Nation. And, indeed, part of that security does come through treaties which have been negotiated and ratified by this Senate.

In any event, all of us are in concurrence on another thing, and that is that we are grateful to you for your appearance here and for your patience. There have been a number of interruptions here this morning. We know that you have a very busy schedule, and we will now stand adjourned.

General ABRAHAMSON. Thank you, Senator.

[Questions for the hearing record with answers supplied follows:]

QUESTIONS SUBMITTED BY SENATOR CARL LEVIN

HEAVY LIFT LAUNCH VEHICLE

Senator LEVIN. I have several questions about SDIO plans for the Heavy Lift Launch Vehicle (HLLV): (NOTE: The name HLLV has been changed to Advanced Launch System or ALS. This was done to more accurately describe the system being pursued, i.e., 1) a total system advancement (manufacturing, launch processing, and vehicle design), not just a vehicle redesign; 2) the ALS will incorporate advanced verses revolutionary technology, and 3) the heavy lift launch vehicle name, indicated a preconceived solution to the requirement.)

If you receive the money you have thus far requested, and plan to request in the future, when would the first HLLV become operational? How many do you currently plan to build?

General ABRAHAMSON. The long-term ALS would be available in the late 1990s; however, the ALS will be designed to enable key technologies to be made available earlier for a mid-1990s interim ALS. There is a national need for the ALS whether or not SDI is deployed. SDI would only use the ALS if the Nation were to decide to deploy a strategic defense system. Until such a decision is made, the Nation will not be procuring any ALS vehicles for ballistic missile defense. SDIO recognizes the ALS would be an important element of any deployment which is why we are funding the concept definition studies and the key technologies as identified in the 2 year joint DOD and NASA Space Transportation Architecture Study (STAS).

NON-SDI LIFT REQUIREMENT

Senator LEVIN. Is there any non-SDI lift requirement that could not be met with other lift assets we already have or plan to acquire between now and 1998?

General ABRAHAMSON. There is no one requirement that could not be met by current systems. However, even the normal growth national mission model, without SDI or large civil space initiative, will exceed national launch capacity without ALS. Moreover, with no launch margin, the Nation will have no growth capacity for future space activities or significant launch stand downs as experienced over the past year and a half. All national space users require low cost and assured access.

REDUCTION IN LAUNCH COSTS FOR HLLV

Senator LEVIN. What is the goal for reduction in launch costs for the HLLV? What order of magnitude reduction cover current launch costs does that goal represent? Please measure launch costs in dollars per pound of payload.

General ABRAHAMSON. The Advanced Launch System (ALS) to be available in the late 1990s will have a goal of an order of magnitude reduction in launch cost order as compared to current systems. Current launch systems generally cost from $3,000 to $4,000 per pound of payload. Thus the late 1990s ALS system cost goal would be $300 to $400 per pound.

SDI DEPLOYMENT COSTS

Senator LEVIN. Is your estimate of a $40–$60 billion cost for the first two phases of SDI deployment based on achieving that reduction in launch costs referred to in C) above? How much of the $40–$60 billion is due to launch costs? What would be the cost of phase 1 and 2 SDI deployment using current launch costs?

General ABRAHAMSON. The $40–$60 billion cost (FY 1985 dollars) refers to the first 5 years (analogous to FYDP) of the first phase of a strategic defense system concept consisting of BSTS, ERIS, SB1, Probe, BM/C3, launch and integration functions. That particular architectural concept is currently undergoing review in order to take advantage of refined component designs and align acquisition schedules with fiscal constraints.

For the concept at hand, launch costs are 11.2% of the total FY 88–95 costs, and 6.5–7.4% of the FY 88–92 costs. This variation occurs because of the distribution of launches toward the later, or deployment phase of the concept. Launch costs for this plan were developed based on a combination of launch vehicles, current Titan IVs and initial versions of a notional ALS (85,000 lbs to nominal low earth orbit). We assume SDIO would fund its fair share of development costs. Use of current systems would require many additional launch facilities (Approximately $32B), as well as a new launch range. Vandenberg AFB, the Nation's only high inclination launch site, cannot accommodate the number of pads required using Titan boosters. However, for purpose of comparison, if current launch vehicles and costs were used, the recurring concept deployment cost would roughly double, so that launch costs would be $9–13 billion (FY 1985). This is likely to be an upper range for the program due to economies of production associated with high volume use of current launch vehicles.

SOVIET TESTS ON ABM SYSTEMS

Senator LEVIN. Has the United States concluded that the Soviet Union has tested, developed, or deployed an antiballistic missile system or component which is sea-based, space-based, air-based, or mobile land-based, in violation of the traditional interpretation of the ABM Treaty?

General ABRAHAMSON. [Deleted.] The Krasnoyarsk radar, essentially identical to the other large phased-array radars that the Soviets have acknowledged to be for ballistic missile detection and tracking, violates the 1972 ABM Treaty. The radar is not located on the periphery of the USSR and pointed outward, as required for early warning radars. It is some 750 kilometers from the nearest border—Mongolia—and it is oriented not toward that border, but across approximately 4,000 kilometers of Soviet territory to the northeast.

The Soviet Union claims that the Krasnoyarsk radar is designed for space tracking rather than for ballistic missile early warning, and therefore does not violate the ABM Treaty. Its design and orientation make clear that this radar is intended for ballistic missile detection and target tracking in the LPAR network.

The growing network of large phase-arrays radars, of which the Krasnoyarsk radar is a part, is of particular concern when linked with other Soviet ABM efforts. These radars take years to construct and there existence could allow the Soviet Union to move to deploy a nationwide ABM defense. The degree of redundancy being built into their LPAR network is not necessary for early warning. It is highly desirable, however, for ballistic missile defense.

During the 1970s the Soviets developed components that could be integrated into an ABM system that would allow them to construct individual ABM sites in months rather than the years required for more traditional ABM systems. The development and testing of the components represent a potential violation of the ABM Treaty's prohibition against the development of a mobile land-based ABM system or components.

The Soviet Union has conducted tests that have involved air defense radars in ABM-related activities. The large number, and consistency over time, of incidents of concurrent operation of ABM and SAM components plus Soviet failure to accommodate fully U.S. concerns, indicate the USSR probably has violated the Treaty's prohibition on testing SAM components in an ABM mode. Additionally the SA-X-12/GIANT system may have the potential to intercept some types of strategic ballistic missiles. The SA-12 system is expected to have widespread deployment. The technical capabilities of this system highlights the problem that the improving technology is blurring the distinction between air defense and ABM systems. This problem will be further complicated as newer, more complex air defense missile systems are developed. Taken together, all of their ABM and ABM-related activities suggest that the Soviets may be preparing ABM defenses of their national territory.

SOVIET INTERPRETATION OF ABM TREATY

Senator LEVIN. Were the Soviets to operationally adopt the "broad" interpretation of the ABM Treaty, how much more quickly could they develop a nation-wide breakout potential of military significance?

General ABRAHAMSON. They have the capability for a militarily significant nationwide breakout using the [deleted] regardless of whether they adopt a "broad" or "narrow" interpretation of the ABM Treaty.

Senator LEVIN. Which interpretation of the ABM Treaty provides the United States with a greater hedge against Soviet ABM Treaty breakout and deployment of militarily effective strategic defenses?

General ABRAHAMSON. Clearly, the broad interpretation provides the greater hedge. A decision to restructure the U.S. SDI Program under the broad interpretation would accelerate the overall Program, allow more direct and realistic testing, and permit us to better use our resources. We know that the Soviets for many years have been-pursuing a robust strategic defense program of their own. The testing which is permitted by the broad interpretation would better serve as a hedge against Soviet activities that we know of, and more importantly, those of which we are unaware.

EARLY DEMONSTRATIONS

Senator LEVIN. A workshop report of the Stanford Center for International Security and Arms Control noted the following:

"A considerable body of evidence has shown that early demonstrations of new technologies have two deleterious effects. First, they tend to freeze the technology being demonstrated before it is fully mature, thus guaranteeing less than full capability. Second, they tend to absorb money from the associated R&D program, thus eliminating the possibility of better solutions. In a program such as boost phase defense, in which the most promising technologies have the farthest to go, early demonstrations thus may effectively eliminate any change of success."

Have you taken these factors into account in your evaluation of the cost and time implications of adopting the broad interpretation and conducting early demonstrations of various SDI technologies?

General ABRAHAMSON. Yes. We have and will continue to assess the cost and time implications of conducting demonstrations of various SDI technologies. Our main concern is to provide convincing and valid demonstrations of the readiness of those technologies to support an informed decision on whether to develop and deploy a defense of the U.S. and its allies against ballistic missile attack. We believe the key to providing the broadest possible range of defense options as a basis for making this important decision is the pursuit of a balanced program, involving a combination of near term and longer term deployment options. Not only must validation of the more mature and promising technologies be completed to facilitate making an informed development and deployment decision, but we must also aggressively pursue a technology base research effort to establish the feasibility of our most advanced defense concepts. This is the only way we can take full advantage of the opportunity to anticipate increased Soviet offensive and defensive capabilities, and provide the needed strong incentive to "build down" our mutual reliance on offensive deterrence systems.

The real challenge behind this balanced strategy is to maintain it in an environment of reduced funding. Should the SDI appropriation for fiscal years 1988 and 1989 suffer the same level of reduction from the amounts requested (33%) fiscal year 1987, such a balanced approach would be impossible and the program would be forced to choose between a first generation system based upon more mature technology, but which is clearly recognized to be limited, and a longer term research program designed to provide for a robust, enduring capability, thereby, foregoing any possibility of operational capability before the end of this century.

STRATEGIC NUCLEAR ATTACKS

Senator LEVIN. Do you believe major uncertainties about the outcomes of strategic nuclear attacks on the United States exist today in the minds of Soviet military planners? Do you believe that we are incapable of disrupting Soviet strategic nuclear attack timing today?

General ABRAHAMSON. The Secretary of Defense's Annual Report to the Congress for fiscal year 1988 includes a lengthy discussion of the strategic balance, including the following assessment: "For the immediate future, our planned offensive force modernization appears sufficient to maintain a robust deterrent to a Soviet nuclear

attack on the United States and our allies." However, continued Soviet efforts to develop strategic defense capabilities, in conjunction with their extensive offensive nuclear buildup, pose a serious challenge to U.S. and allied security. Soviet progress, if permitted to continue over the long term without analogous U.S. advances, will undermine the military balance which is essential to effective and stable deterrence. We believe that effective strategic defenses, which would dramatically raise Soviet uncertainty about the outcome of any attack, will provide the basis for a far more stable and secure deterrence.

"THREAT ANALYSIS" IN SYSTEMS ANALYSIS AND BATTLE MANAGEMENT ACCOUNT

Senator LEVIN. In fiscal year 1986 you allocated $16.4 million to "Threat Analysis" in the Systems Analysis and Battle Management Account. In fiscal year 1987 you allocated only $1 million and in fiscal years 1988 and 1989 only $1.3 and $1.6 million respectively. In fiscal year 1986 you allocated $6.1 million to countermeasures in that account and $5 million in fiscal year 1987, but no money at all in either fiscal year 1988 or 1989. Why the sudden reduction in these programs? Has the threat to be analyzed dropped off or stopped improving? Is there somehow less reason to study and evaluate countermeasures over the next 2 years? Please explain the trend in these accounts.

General ABRAHAMSON. The actual trend in our funding of threat and countermeasures work is upward throughout the period fiscal year 1986 through fiscal year 1989. We are in the processes of centralizing our management of this work under one individual and combining the associated budget lines into one location in the Survivability, Lethality and Key Technologies Account. Considering this, the actual funding for these projects is as shown below.

FY 86.—$31.2M.
FY 87.—$32.7M.
FY 88.—$44.1M.
FY 89.—$78.4M.

DEVELOPING SPACE-BASED ABM SYSTEMS

Senator LEVIN. Do you agree that we cannot test or develop space-based ABM systems or components which are not "based on other physical principles" under either interpretation of the ABM Treaty.

General ABRAHAMSON. Under the restrictive interpretation, the only ABM systems, components or component substitutes that can be developed and tested are those that can be considered to be fixed ground based. Under the broad interpretation, ABM systems and their components, as defined in Article II of the Treaty, can only be developed and tested if they are fixed ground-based; ABM systems that are based on other physical principles and including components that can substitute for ABM interceptor missiles, ABM launchers, or ABM radars may be developed and tested regardless of their basing mode.

AGREED STATEMENT D OF ABM TREATY

Senator LEVIN. You testified that the definition of the term "based on other physical principles" which appears in Agreed Statement D of the ABM Treaty is a policy decision to be made within the administration. Who within the administration will determine (or recommend to the President) the "official" definition of that phrase? When will that decision be made?

General ABRAHAMSON. Decisions on the definition of "other physical principles" are made on a case-by-case basis. In some cases, the situation is clear; the ABM Treaty negotiating record clearly identified certain physical principles applicable to strategic defense as "other physical principles." In other more ambiguous cases, the decision as to whether a physical principle applicable to strategic defense was an "other physical principle" would have to be made by the President, drawing on the recommendations of the concerned executive branch agencies.

IMPLEMENTATION OF SAL AGREEMENTS

Senator LEVIN. Assume for the purposes of answering this question that the President decides to operationally adopt the "broad" interpretation of the AMB Treaty. Do you agree that before conducting a test of any ABM system or component in space under the "broad" interpretation that you must seek guidance from Under Secretary Godwin on whether or not that system or component is based on other physical principles?

General ABRAHAMSON. In accordance with DOD Directive 5100.70, 9 January 1973, *Implementation of SAL Agreements,* the Under Secretary of Defense for Acquisition, Mr. Godwin, ensures that all DOD programs are in compliance with U.S. strategic arms control obligations, including obligations under the ABM Treaty. This responsibility applies independent of whether the President decides to adopt the "broad" interpretation of the ABM Treaty.

SDI RESEARCH BREAKTHROUGHS

Senator LEVIN. What breakthroughs in SDI research have occurred since March 1, 1986? Please describe the breakthroughs in some detail.

General ABRAHAMSON. The term "breakthrough" is rather ambiguous, and may be interpreted in various ways. What one person calls a "breakthrough" another may prefer to call a "significant technical advance."

There are numerous examples of "significant technical advances" that have left us optimistic about the ultimate prospects for a successful SDI program. Many of these examples are reported in our Annual Report to Congress for fiscal year 1987. The various areas in which progress has been made include:

Kinetic Energy Interceptors;
Directed Energy (Interceptors and discrimination);
Sensors (Surveillance, acquisition, tracking and kill assessment;
Battle Management and Command, Control, and Communications (BM/C3);
Survivability, Lethality, and Key Technologies (SLKT).

In the area of *kinetic energy,* two major experiments were carried out in FY 1986, involving proof-of-principle demonstrations designed to support full-scale engineering development decisions in the early 1990s timeframe. Both experiments yielded much needed data. In the first experiment (FLAGE), the U.S. Army demonstrated a number of successful direct impact homing intercepts of low radar cross-section targets at low altitude, the last of which involved an actual air-launched reentry vehicle simulator traveling at a velocity of about 2 kilometers per second. The second experiment, Delta 180, was successfully launched on 5 September 1956. In this experiment, critical space observation data were obtained, and an actual dynamic space intercept was conducted. This extremely complex experiment explored and verified, in spectacular detail, several previously problematic aspects of the SDI mission, and also revealed a number of new phenomena which will require further study. This entire experiment, from initial conception to final launch, took less than 18 months, required the writing of 1,000,000 lines of new computer code (done in 6 months), and involved over 30 ground, airborne, and space sensor suites.

The Kinetic Energy Technology Base Program is providing the research necessary for developing low weight and low cost components for ground-based and space-based interceptors. These components can generically be broken into seeker units, navigation units, processor units and divert and axial propulsion unit technologies. The past year has led to demonstration of hardware size reduction and performance increases in each component area. Of these, the most dramatic has been in the brass board demonstration of the new inertial navigation unit concept known as the Resonant Fiber Optics Gyro. This inertial navigation unit has the potential to fulfill the requirements of many other military and commercial applications, and consequently, will find significant uses in non-SDIO systems.

In the field of *directed energy* (DEW), major achievements in chemical lasers included megawatt class experiments that yielded the brightest laser outputs in the free world. Precision optics fabrication processes for very large, segmented mirrors (4 meters or larger in diameter) and complex shapes were developed. These advances plus new proof-of-principle results in phase-locking chemical laser outputs and in optical phased arrays provided substantial new evidence of the potential feasibility of achieving space-based lasers of very high brightness. For ground-based lasers, advances in free electron lasers led SDI to initiate a much more aggressive technical program to achieve high performance levels. One major accomplishment consisted of bringing down the capital cost of laser power from a few thousand dollars per watt to a few hundreds of dollars. SDI's goal is to bring this cost down by another factor of ten. The neutral particle beam program was another segment of the DEW Program that had some dramatic advances recently. The highest brightness pulsed hydrogen ion accelerator in the Free world was operated, and a technique for determining the direction that the beam is propagating to the target was validated. In addition, a high brightness negative ion source that operates continuously was developed for the neutral particle beam program.

In the *sensors* area significant technical advances have taken place over the past year in multispectral sensors and their associated signal and data processing. First,

work progressed on the demonstration of a real time discrimination capability. This is the first system to perform real time radar imaging of ballistic missiles, reentry vehicles, and penetration aids. Second, the preliminary design for the x-band phased array Terminal Imaging Radar was completed. This ground-based sensor will be capable of producing high-resolution images of distant potential targets and will permit discrimination of warheads from decoys in the endoatmosphere. Such radar technologies will be available for experimental validation in the late 1980s. Third, an encouraging milestone occurred this year when a functional cryocooler design successfully demonstrated a 5-year lifetime, proving the feasibility of an active cooler for the long wavelength infrared surveillance mission. In addition, an integrated performance demonstration of the backup cryocooler design was also successful. Last, miniaturization and advances in optical sensor performance, design, fabrication, and testing provided rapid gains in surveillance technologies. Multispectral measurements of booster, post-boost vehicle, and reentry vehicle signatures obtained by optical devices allowed us to better understand threat signatures and will be used in the design of advanced sensors, as well as in the development of discrimination techniques.

To support reliable, responsive and survivable *battle management, command, control and communications (BM/C3)* for strategic defense, we are pursuing technology advances in algorithms, computers, communications systems, and in software engineering. The issue of feasibility of developing software for SDI has received a lot of attention in the press and in our studies. Our studies have shown that if we are careful about the overall architecture design and minimize the amount of coordination required among system elements, the task of developing software for a reliable, fault-tolerant SDI system can be made tractable. In addition, we are taking advantage of major advances in computational capability, computing speed, and size reduction of computer hardware to simplify software development.

A last area in which notable progress fitting the definition of a significant technical advance has occurred is *Survivability, Lethality, and Key Technologies (SLKT).* The first numerical justifications for synergistically applying multiple survivability options to architecture designs were completed. Findings verified that first order simulations previously performed may have reached results far less favorable to the defense than is now indicated. When trades are performed among multiple survivability options such as hardening, shoot-back, electronic warfare, maneuvering, and decoys, the resulting probability of survival is much higher than previously expected. The effects on reducing the number and complexity of defensive assets are only just beginning to emerge. In addition, a star tracker hardened to the near-term threat level nuclear environment was produced and tested. Star trackers will be an essential part of satellite attitude, navigation, and autonomous subsystems. Additional tests will be performed this year to determine ultimate hardness of the near-term star tracker design.

A major milestone in the Lethality and Target Hardening Program was to resolve an issue regarding Q^*, the effective heat of ablation (heat energy required for material removal) for materials hardened against laser radiation. Previous experiments at moderate laser intensities and small spot sizes created two conflicting stories. Some experiments predicted that Q^* would rise at the high laser intensities, thus indicating that higher laser brightness might not be effective, while other experimenters under the same conditions predicted it would level off or even decline at the higher laser intensity. The numerical value of Q^* is important because it dictates the kill time and the brightness required of Space Based Lasers (SBL) to be effective against laser hardened boosters.

To resolve this issue, the Air Force Weapons Laboratory conducted a series of experiments utilizing the Mid Infra-Red Advanced Chemical Laser (MIRACL) at White Sands Missile Range, NM, from September to October 1986. The results of these experiments indicate the Q^* does not increase at the higher intensities but levels off at some threshold. The advanced laser hardened composites did not fare very well. Some of the metal loaded composites had Q^* values that were 50% less than their previously advertised capabilities. Moreover, this experiment was a major step forward in defining the requirements for space based lasers to be effective against laser hardened boosters and thereby increased their role in the boost phase intercept mission.

While not a product of SDI funded research, the recent advances in "warm" superconducting materials are making a very significant contribution to the feasibility of defenses. The thermal losses, and hence the refrigeration costs, associated with the high temperature superconductors are significantly less than those associated with "ordinary" superconductors. The operating expenses of a large superconducting magnetic energy storage (SMES) would therefore be expected to be greatly re-

duced if the new materials could be employed. Two recent studies have indeed shown this to be true; however, since conduction costs dominate, the total effect on life cycle costs was shown to be only in the 5–10% range. Of greater importance is the contribution of the materials to construction confidence, or risk reduction. Present SMES designs employ superfluid helium at 1.8 degrees Kelvin; construction and operating experience with other large magnet systems similarly designed (e.g., Fermilab's accelerator) indicates great difficulty in initial checkout, leak detection, and operation. The new materials would completely eliminate the complexities.

BROAD INTERPRETATION OF THE ABM TREATY

Senator LEVIN. What is your estimate of how much sooner and cheaper your current Phase I system could be developed and deployed under the "broad" interpretation?

General ABRAHAMSON. The effect provided in a report to the ABM Treaty has been provided in a report to the Congress. The differences between an SDI Program which continues to be conducted under the restrictive interpretation of the treaty, and restructured program that we could pursue under the broad interpretation, are significant. The broad interpretation would allow program manager to design realistic tests to integrate weapons, sensors and battle management/command, control and communications. Holding constant the level of confidence necessary for a deployment decision, the broad interpretation would reduce costs significantly and allow for greater efficiency. We estimate that it would save 2 years in the research program and at least $3 billion in establishing the feasibility of an initial defense against ballistic missiles.

SDI FULL SCALE ENGINEERING DEVELOPMENT

Senator LEVIN. Since March 1, 1986, have you changed your view regarding our inability to make a Full Scale Engineering development decision on SDI before the mid-1990s? If so, what has specifically happened that contributed to that in your view?

General ABRAHAMSON. Since March 1, 1986, SDI has accomplished a great deal of work in developing technology and defining system concepts. As a result of this progress, it has become clear that a phased approach to the deployment of Strategic Defense System (SDS) makes the most efficient and effective use of limited resources. A phased approach to SDS puts a different meaning on the "Full Scale Development decision." This approach is implemented by having FSD decisions for each of the phases. [Deleted.] We expect to demonstrate the feasibility of the second phase SDS before a decision to deploy a first phase of such a system.

ADMINISTRATION DEFINITION OF AGREED STATEMENT D

Senator LEVIN. You testified that to your knowledge there is no official administration definition of the term "based on other physical principles" which appears in Agreed Statement D of the ABM Treaty. Is it true that there is no official administration definition of that term?

If so, why does your written testimony contain a definition of that phrase: (i.e., other than the physical principles used in 1972 in ABM interceptors, ABM launchers, and ABM radars)? If there is no official administration definition of that key phrase, how can you say, as you did in your written testimony, that optical sensors are "based on other physical principles?"

If not, what is the official administration definitions?

General ABRAHAMSON. (A) The administration is continuing to review the applicability of the phrase "other physical principles" to the various elements of the SDI program.

(B) My written testimony does not include a definition, only a description. The phrase "other physical principles" by the use of the word "other" implies the comparison to something (i.e., "other" than what?) and the answer seems to be other than those principles incorporated in the ABM systems defined in Article II. This description is supported by exchanges in the treaty negotiating record as well.

(C) The reference to optical sensors is from an example taken from the negotiating record. Optical telescopes were referred to an exotic or "other" technology which could be deployed if they were an adjunct, but could not be deployed if they were a component substitute. Both sides agreed to this position.

(D) There is no official administration position on the definition of this term for all situations. Thus, treaty compliance evaluation is made on a case-by-case basis.

NITZE CRITERIA FOR ABM SYSTEM

Senator LEVIN. Has ABM system been proposed with the SDIO which you have determined to meet the Nitze Criteria? If so, do you have a cost estimate for that system or systems? Please supply those cost estimates.

General ABRAHAMSON. SDIO is in the process of developing and refining a strategic defense architecture concept. This concept will seek to identify levels of technical capability that will enable us to satisfy our criteria of military effectiveness, cost effectiveness and survivability. It is too early in the research program to identify costs, since the cost would depend on a number of factors that have not been fully defined (i.e., capability and efficiency of sensors and weapons, launch capability, and architectures).

Senator LEVIN. Do you understand the Nitze Criteria to mean anything other than what Ambassador Nitze described them as:

"The technologies must produce defensive systems that are survivable; if not, the defenses would themselves be tempting targets for a first strike. This would decrease rather than enhance stability. New defensive systems must also be cost effective at the margin. That is, they must be cheap enough to add additional defensive capability so that the other side has no incentive to add additional offensive capability to overcome the defense. If this criterion is not met the defensive systems could encourage a proliferation of countermeasures and additional offensive weapons to overcome deployed defenses instead of a redirection of effort from offense to defense."

If so, how do you define the Nitze criteria?

General ABRAHAMSON. The President's policy has long been that defenses against ballistic missiles must be militarily effective, survivable, and cost-effective at the margin. I would note that it would be incorrect to refer to these as the "Nitze criteria." They are the President's criteria. Briefly stated, their meaning is as follows:

First, the defense must be militarily effective. A defense against ballistic missiles must be able to destroy sufficient portion of an aggressor's attacking forces to deny him confidence that he can achieve his objectives. In doing so, the defense should have the potential to deny that aggressor the ability to destroy a militarily significant portion of the target base he wishes to attack.

Second, effective defenses must be survivable. They must maintain a sufficient degree of effectiveness to fulfill their mission even in the face of determined attacks against them, thereby contributing to stability by discouraging such attacks.

Third, a deployed strategic defense system must be cost-effective. We will consider in our evaluation of strategic defense options, the degree to which certain types of defensive systems, by their nature, encourage an adversary to try to overwhelm them with additional offensive capability, while other sytems can discourage such a counter effort. We seek defensive options which provide clear disincentives to attempts to counter them with additional offensive forces. This means that—as with other military systems—these defensive options should be able to maintain their capability more easily than countermeasures could be taken to defeat them. This criterion is couched in terms of cost-effectiveness at the margin; however, it is much more than an economic concept.

REVISED SDI BUDGET

Senator LEVIN. If the President decides to operationally adopt the "broad" interpretation of the ABM Treaty will you submit a revised SDI budget request for fiscal years 1988 and 1989?

If so, how soon after a Presidential decision to adopt operationally the "broad" interpretation could we expect to see such a revised request? What kind of revisions would you expect to make in such a request?

General ABRAHAMSON. The current budget request for fiscal years 1988 and 1989 is based upon adherence to the restrictive interpretation of the ABM Treaty. Clearly, efficiencies and overall cost savings would result if the SDI Program were restructured under the broad interpretation. A reallocation of funds over the Five Year Defense Plan would be appropriate in order to provide additional SDI funds for certain early experiments which could be accomplished under the broad interpretation.

AGREED STATEMENT D

Senator LEVIN. You testified that the definition of the term "based on other physical principles" which appears in Agreed Statement D of the ABM Treaty is a policy decision to be made within the administration. Who within the administration will

determine (or recommend to the President) the "official" definition of that phrase? When will that decision be made?

Mr. GODWIN. I understood at the time I testified, that Judge Sofaer was conducting an analysis on this issue and would make recommendations to the President who would make the final decisions.

COMPLIANCE WITH ABM TREATY

Senator LEVIN. During the hearing you said that you would supply for the record the instructions and procedures for compliance with the ABM Treaty which were issued within the Defense Department before calendar year 1985. Please do so.

In your view, did those instructions and procedures in effect within the Defense Department prior to 1985 require compliance with the traditional or narrow interpretation of the treaty, as opposed to the "broad" interpretation?

Mr. GODWIN. As I previously stated in my testimony and also for the record, the instructions and procedures for compliance with the ABM Treaty are contained in Department of Defense Directive 5100.70, entitled Implementation of SAL Agreements and Department of Defense Instruction S–5100.72 entitled Procedures for the Implementation of Strategic Arms Limitation (SAL) Agreements and Measures Agreements. These documents are the implementing instruction for assuring continued compliance with all U.S.-Soviet Strategic Arms Limitation and Measures Agreements presently in force. They provide a general framework of guidelines within which the compliance program for DOD will operate. The procedures in DODI5100.72 treaty. These experiments are discussed in Appendix D of the 1987 Report to Confied by the the President's decision no longer to abide by the provisions of the SALT treaties. In October 1985, the President directed that as a matter of policy the SDI program continue to be conducted according to a more restrictive interpretation of the ABM Treaty than the United States could justifiably observe. All SDI experiments submitted to the Congress in FY 1987 are compliant with the more restrictive interpretation of the ABM Treaty; however, the President has reserved the right to restructure the SDI program to take full advantage of the broader bounds of the Treaty. These experiments are discussed in Appendix D of the 1987 Report to Congress on SDI. This regulation, classified SECRET, is included in its entirety as the response to an earlier inquiry by Senator Levin.

QUESTIONS SUBMITTED BY SENATOR JOHN GLENN

SPACE REQUIREMENT FOR NTF

Senator GLENN. General Abrahamson, what is the total space requirement for the NTF?

General ABRAHAMSON. The NTF will be a complex of buildings with facilities for administration, research and utilities/facilities support. The total space requirements for these activities are currently designed at 443,000 square feet. Of this total 276,400 square feet is for the research facility housing the computer center for experiment and simulation activities.

Senator GLENN. How many people will the NTF ultimately need to accommodate?

General ABRAHAMSON. The NTF has been designed to house approximately 2,300 people with room for augmentation by as many as 400 temporary duty persons for a total population on a daily basis of 2,700 people. This large number of persons would work on a shift basis with the population at approximately 2,000 persons during normal working hours.

COST OF NTF

Senator GLENN. What is the total estimated cost of the NTF?

General ABRAHAMSON. The current estimate for construction of the NTF is $98.9 million. The design of the facility will cost approximately $9.5 million.

Senator GLENN. What is the status of funding for the NTF?

General ABRAHAMSON. The design is being accomplished with planning and design funds previously appropriated. The construction is to be completed with the funds requested in the fiscal year 1988 budget request.

Senator GLENN. When will the planned NTF be completed and ready for occupancy?

General ABRAHAMSON. Assuming that our fiscal year 1988 budget request is approved then construction could begin in the Spring of 1988 and result in a beneficial occupancy date in the Summer of 1989.

Senator GLENN. What is the total military construction costs required to house the NTF at CSOC on an interim basis? What is the total cost of equipment required for the NTF interim facility and will it be purchased with R&D or MILCON funds?

General ABRAHAMSON. Because of the unique features of the CSOC we do not require any MILCON funds for the temporary installation of equipment for the Interim NTF. The equipment, its installation and operation will be funded from our R&D request. Equipment procurement for the INTF will be contained in a contracting effort that will be solicited within 30 days. It would be inappropriate for me to give specific cost estimates in open session at this time.

GCEP FACILITY AT PIKETON

Senator GLENN. Is the GCEP facility at Piketon suitable for other key SDI R&D or NTB projects including the Rail Gun Project and the High Energy Neutral Particle Beam Accelerator?

General ABRAHAMSON. The GCEP facility at Piketon has many attractive features that may be suitable for numerous research activities. The SDIO is currently reviewing the capabilities of the GCEP facility and attempting to match ongoing research efforts with the features provided by the GCEP facilities. A Manufacturing, Operations, Development and Integration Laboratory (MODIL) is one current effort, in support of the HLLV and other developments, that may be suitable for the GCEP facility. Other efforts including the above mentioned rail gun and neutral particle beam research will be considered for inclusion at the GCEP facility. The Neutral Particle Beam Integrated Space Experiment (NPBISE) Test Facility, as an example, is currently in a site selection process. The GCEP facility could possibly be a candidate site.

However, it should be noted that a number of possible sites are available for each of the above activities and budget cuts in past years have tended to delay decision dates for these activities. It is not the intent of SDIO to preclude the possible use of any government facility for other productive purposes either by the government or private enterprise.

SDI CONTRACTS

Senator GLENN. General Abrahamson, last year when you testified before this subcommittee on March 25, 1986 you stated in regard to the award of SDI contracts abroad: "I think by the time the committee has before it next year's SDI authorization, we will see very broad participation by the majority of those countries that were invited to participate in the program." What nations are participating in the SDI program and how great is their participation? How much do you think foreign participation in SDI will grow in the future?

General ABRAHAMSON. Since last year, Memorandums of Understanding (MOU) have been signed with the Federal Republic of Germany, Israel and Italy. These were in addition to the MOU we had already signed with the United Kingdom. We have research underway in all of the MOU countries, France, Belgium, The Netherlands and Canada. This consists of approximately 65 contracts with a value of nearly 100 million dollars. We have ongoing negotiations with the Japanese that could lead to an MOU, and we have hosted a government visit from officials in Korea.

Our invitation to allies to participate in the program is based on mutual defense needs and the recognition that they possess significant talents and, in many cases, unique technologies that could be of significant benefit to the goals of the SDI. Allied participation will probably increase in specialized technology areas, based on technical merit and cost.

SDI DEPLOYMENT COSTS

Senator GLENN. General Abrahamson, in a meeting in your Pentagon office a few weeks ago, you told me that you estimated that the first phase of a deployed SDI system would cost between $40–60 billion. The President's Special Advisor on Arms Control, Mr. Paul Nitze, has argued that two criteria must be met before the deployment of strategic defenses (SDI) could be justified: the defense must work even in the face of a direct attack, and it must be cheaper to augment the defense than the offense (the so-called Nitze criteria). Do you believe the SDI will be able to meet both of these criteria in the foreseeable future?

General ABRAHAMSON. The basic requirements for an appropriate strategic defense system are that it must be militarily effective, be survivable, and cost effective. There has been substantial progress in the SDI research program. This

progress indicates that a strategic defense which satisfies those basic requirements may indeed be possible. We would consider incremental strategic defense options, options which would clearly add an element upon which the larger system—the system to meet the overall objective—could be built.

QUESTIONS SUBMITTED BY SENATOR WILLIAM S. COHEN

1978 AGREED STATEMENT D OF THE ABM TREATY

Senator COHEN. Does the fact that an interceptor has the capability to intercept a strategic ballistic missile or its elements in flight trajectory without being guided by an ABM radar imply that the interceptor is not an "ABM interceptor missile?"

Mr. GODWIN. Both the United States and the Soviet Union understand that under the ABM Treaty there may be ABM interceptor missiles given the capability to carry out interception without the use of ABM radars as the means of guidance. However, the administration is currently studying whether such devices would be considered part of an ABM system "based on other physical principles" and thus subject to Agreed Statement D of the ABM Treaty.

Senator COHEN. Does the fact that an interceptor has the capability to intercept a strategic ballistic missile or its elements in flight trajectory without being guided by an ABM radar imply that the interceptor is based on "other physical principles?"

Mr. GODWIN. The administration is currently studying whether interceptor devices given the capability to carry out interception without use of ABM radars as the means of guidance would be considered part of an ABM system "based on other physical principles" and thus subject to Agreed Statement D of the ABM Treaty.

Senator COHEN. Does the 1978 Agreed Statement apply to an ABM interceptor missile that is given the capability to carry out an interception without being guided by an ABM radar, but which does require guidance from something other than an ABM radar?

Mr. GODWIN. The 1978 Agreed Statement says that the application of the expression "tested in an ABM mode" is subject to discussions and agreement in the Standing Consultative Commission (SCC) if ABM interceptor missiles are given the capability to carry out interception without the use of ABM radars as the means of guidance.

Senator COHEN. If an ABM interceptor has the capability to intercept a strategic ballistic missile without being guided by an ABM radar, then "testing it in an ABM mode" would be subject to discussions in the Standing Consultative Commission (SCC). Does this mean that until an agreement is reached in the SCC there are essentially no restrictions on testing that ABM interceptor in the ABM mode?

Mr. GODWIN. Customary international law requires that a treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty in their context and in the light of its object and purpose. Thus, the treaty does contain restrictions, even in the absence of negotiated meanings to specialized terms. However, the administration is currently studying whether such devices would be considered part of an ABM system "based on other physical principles" and thus subject to agreed Statement D of the ABM Treaty.

Senator COHEN. Is the 1978 Agreed Statement legally binding upon the United States and the Soviet Union?

Mr. GODWIN. The 1978 Agreed Statement, which is a part of the ABM Treaty, is legally binding on both the United States and the Soviet Union.

Senator COHEN. Does the 1978 Agreed Statement apply to testing in an ABM mode of nonnuclear Soviet air defense missiles?

Mr. GODWIN. For air defense missiles, the 1978 Agreed Statement does not specifically address "testing in an ABM mode", but it does address the problem of "concurrent testing" of air defense and ABM system components. With respect to "testing in the ABM mode", Article VI(a) of the ABM Treaty prohibits testing any missile, other than an ABM interceptor missile, in the ABM mode.

ABM INTERCEPTORS WITHOUT NUCLEAR WARHEADS

Senator COHEN. Is it true that an interceptor that has the capability to intercept a strategic ballistic missile or its elements in flight trajectory without the use of a nuclear warhead does not imply that it is not an "ABM interceptor missile?"

Mr. Godwin. The Homing Overlay Experiment (HOE) was a program to test interceptor devices which did not use nuclear warheads. The HOE program resulted in the successful destruction of a simulated warhead launched by an ICBM in June 1985. The United States considers the HOE interceptor devices to be "ABM inter-

ceptor missiles." However, the administration is currently studying whether such devices would be considered part of an ABM system "based on other physical principles" and thus subject to Agreed Statement D of the ABM Treaty.

Senator COHEN. Is it true that an interceptor that has the capability to intercept a strategic ballistic missile or its elements in flight trajectory without the use of a nuclear warhead does not imply that it is "based on other physical principles?"

Mr. GODWIN. The ABM Treaty does not contain a definition of what constitutes an ABM system "based on other physical principles." The advance of technology has brought forward interceptor devices different from the radar-guided, nuclear-armed ABM interceptors that were available in 1972 when the ABM Treaty was signed. The administration is currently studying whether such devices would be considered part of an ABM system "based on other physical principles" and thus subject to Agreed Statement D of the ABM Treaty.

OBJECTIVE ABM TREATY COMPLIANCE ASSESSMENTS

Senator COHEN. Please explain the statement in paragraph 2 of page H-9 of the classified Report to the Congress on the Strategic Defense Initiative (1986), why is it different from the unclassified version of the Report and your testimony of 1 April 1987 that "It is an important principle that the U.S. has long held that compliance must be based on objective assessments of capabilities and not subjective judgments as to intent?"

Mr. GODWIN. My testimony on the fundamental principle of compliance is consistent with the most recent Report to the Congress on the Strategic Defense Initiative (dated April 1987) which states on p. D-2: ". . . compliance must be based on the objective assessments of capabilities which support a single standard for both sides and not subjective judgments as to intent which could lead to a double standard of compliance."

SDI BUDGET REQUESTS

Senator COHEN. General Abrahamson, you indicated in your testimony that in reviewing the fiscal year 1988 and fiscal year 1989 SDI budget requests for compliance issues, the endgame booster kill flight experiment for the Space-Based Kinetic Kill Vehicle project was not a compliance issue because the experiment is not planned to be conducted until fiscal year 1990.

Could you clarify this: Are you testifying that the experiment will not be conducted prior to fiscal year 1990? Is this schedule determined by technological or funding constraints?

Your office has indicated that this experiment can be conducted in a fixed, land-based mode at agreed ABM test ranges, in a "non-MIRVed" configuration. Is this correct?

General ABRAHAMSON. The endgame booster kill flight experiment for the Space-Based Kinetic Kill Vehicle project involves a fixed ground-based interceptor from Kwajalein Missile Range that is authorized under the ABM Treaty. [Deleted.]

The front end sensor, computer, inertial reference platform and divert propulsion subcomponents that will be tested are generic to several types of interceptors. The fiscal year 1990 schedule is primarily determined by [deleted] but ongoing proposal evaluations for the experiment may impact that conclusion.

Yes, the experiment will be conducted in a fixed, land-based mode at an agreed ABM test range, [deleted].

QUESTIONS SUBMITTED BY SENATOR DAN QUAYLE

INFRARED SENSORS

Senator QUAYLE. Is infrared sensors based on other physical principles than those used in 1972 to accomplish the task of a radar, one of the three components identified in Article II of the ABM Treaty?

General ABRAHAMSON. No. Infrared sensors would not be one of the three ABM system components identified in Article II of the ABM Treaty.

KKV SYSTEM

Senator QUAYLE. Does the proposed KKV system need a radar to guide the KKV interceptor/sensor in close proximity to its target as is the case with the ERIS system?

Does the KKV systems use SSTS, BSTS and terminal IR sensors to substitute or do the entire task of radars?

General ABRAHAMSON. The proposed space-based KKV system is expected to be given a target in an uncertainty "basket" of about [deleted] on a side when the KKV system opens its seeker [deleted]. That uncertainty basket will probably come with passive sensor (i.e., not radar) track from several sensor platforms. While a final decision has not been made, devices known as laser "radars" are also being considered for including in a space-based KKV system. (These devices would probably use lasers and passive optical sensor to make measurements on targets, and thus would not be considered radars in the contest of the ABM Treaty. The administration has not yet determined whether laser radars are based on other physical principles.) [Deleted.]

The space-based KKV system will use sensor data from [deleted] to get a good enough track on its target to complete an intercept. Those sensor will be primarily passive seekers but may include laser radars.

The ERIS baseline system does not use radars for handover. Instead, data from external sensors, such as SSTS, are used to provide an uncertainty "basket." The Lockheed proposal for an early deployment of ERIS used radars for handover.

Senator QUAYLE. Are the KKV systems IR sensors, then, a substitute for a radar—which is defined as a component under Article II—whereas the IR sensors in the ERIS system are only an adjunct to the ERIS system's radar.

General ABRAHAMSON. The administration is currently studying the applicability of these concepts to both the space-based KKV and the ERIS systems.

TREATY INTERPRETATION

Senator QUAYLE. Wouldn't you need a broad interpretation to test and develop in space a system that actually did a missile intercept using a component that was wholly based on other physical principles than those used in 1972 to do the job of the 3 components listed under Article II of the Treaty—radars, missile interceptors, and missile launchers.

General ABRAHAMSON. Yes, to do such a test in a realistic way. It may be possible to do a series of limited capability tests, none of which could use "ABM capable" devices or be tested in an ABM mode. We would then try to simulate this data and extrapolate and interpolate conclusions to assess the feasibility of using such a system. Obviously this method is less convincing, less accurate and more time consuming than direct testing.

Senator QUAYLE. Under the narrow interpretation of the ABM Treaty couldn't you test, develop, and develop a ground-based system that did intercept a missile that used an adjunct sensor based on other physical principles to help accomplish the job of a radar that is part of the system?

General ABRAHAMSON. Yes. If the ABM system is *fixed* ground based, it can be developed, tested, and deployed with an adjunct sensor based on other physical principles.

[Whereupon, at 12:44 p.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, APRIL 2, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

B-1B AIRCRAFT

The subcommittee met in executive session, pursuant to notice, at 9:08 a.m., in room SR-222, Russell Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Warner, Thurmond, and McCain.

Staff present: Arnold Punaro, staff director; Robert F. Bott, William E. Hoehn, Jr., and Ronald P. Kelly, professional staff members; Colleen M. Getz, research assistant; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Milton D. Beach and Donald A. Mitchell, assistants to Senator Glenn; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; and Henry D. Sokolski, assistant to Senator Quayle.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will come to order.

We are meeting in closed session this morning and will not be using the microphones, so we would ask the witnesses to speak up just a little bit more than they might normally have their voices up.

The Subcommittee on Strategic Forces and Nuclear Deterrence meets today for the 17th, and I am pleased to say, next to the last, hearing before the markup, which begins hopefully sometime next week.

We meet this morning to receive additional testimony on the B-1B bomber from two sources: the GAO, at the request of this and many other congressional committees, has been asked to look into the well-publicized problems of the B-1, what those problems are, and what we have experienced since deliveries to SAC began last year. The Office of Test and Evaluation, the Pentagon's so-called

"testing czar" has also been involved in assessing the B–1B's capabilities.

I have asked both of today's witnesses to please spare us a discussin of fuel leaks, which seem to be on the mend, and of the problems with the terrain-following radar and stability and stall-inhibit systems, unless they do not believe those are on the way to solution.

Instead, I have asked our witnesses to focus on the well-publicized shortcomings of the offensive and defensive ECM systems. I have asked them to give us their best assessments of how well understood the nature and extent of the problems are, of how well-defined the course of action to fix these problems is, and of how much time and money will be required to achieve something approaching the capability that was initially envisioned for this airplane.

In sum, we need to ask for your best judgments as to whether we can fix this airplane for the $600 million and the year-and-a-half that the Air Force claims, or whether the distinguished Chairman of the House Armed Services Committee is closer to the mark at $3 billion and 4 years or more to fix it.

Since the B–1 will sooner or later become a launch platform for air-launched cruise missiles, there clearly is a limit to how much we should be willing to invest in fixes, and we clearly want some assurance that we can fix it before the Soviet air defenses become so robust that it cannot penetrate even for the fixed amount of dollars that were being talked about to do that.

Finally, I will ask each witness to comment on what lessons we should draw from the B–1B experience to be applied to the ATB, or "stealth" bomber program.

Our first witness today is Mr. Frank Conahan, who is the Assistant Comptroller General of the National Security and International Affairs Division of the General Accounting Office.

We welcome you, Mr. Conahan. I know from the staff that you have been even busier testifying than this subcommittee has been with all of its hearings. We are grateful that you are willing to appear here today.

Following Mr. Conahan's testimony and a round of questioning, we will hear then from Hon. John Krings, the Director of Operational Test and Evaluation in the Pentagon.

When you begin your testimony, Mr. Conahan, I would appreciate it very much if you would introduce those you have brought with you this morning. We welcome them, also.

But before we begin, let me call on our ranking minority member, my friend the Honorable Strom Thurmond, from South Carolina, for his opening comments.

Senator THURMOND. Thank you very much, Mr. Chairman.

Mr. Chairman, I want to congratulate you for having this third hearing on the B–1B issue. Your diligence, and that of the subcommittee on the problems confronting the B–1B aircraft attest to the seriousness with which we all view the current situation.

Mr. Chairman, I join you in welcoming our two panels this morning. It is the first time that either of these gentlemen have appeared, I believe, before this subcommittee and I look forward to their testimony.

I would hope that the testimony that we receive this morning will give us some insights into the lessons learned and being learned from the B–1B experience, so that we can apply these lessons to future acquisitions.

It is not enough, in my judgment, to simply prescribe "fly before you buy" without weighing the total system cost and risk factors involved in development and production programs that are concurrent from those that are not.

I will be interested in hearing the views of our witnesses on the strengths and weaknesses of the two approaches in view of the B–1B experience.

Mr. Chairman, I have got two other committees this morning. I will stay as long as I can, and later I will be briefed on this testimony, but I value highly their experience and the opinions of these distinguished witnesses this morning.

Senator EXON. Thank you very much, Senator Thurmond.

Mr. Conahan, before you begin, since this is a matter of keen interest to the subcommittee and to the full committee, I am wondering if it would be appropriate if the subcommittee agreed, and if you would agree, that your testimony be incorporated as part of the record.

There will be other Senators, and their aides will be over looking at this testimony, and the testimony I guess that you are about to give might be helpful. Would there be anything wrong with incorporating that as part of the hearing record, as long as it is classified as secret?

Mr. CONAHAN. I think that it would be extremely useful to incorporate it as part of the record.

Senator EXON. We will incorporate the whole report, then, that you are about to give as part of the record, and ask you to proceed at this time.

STATEMENT OF FRANK C. CONAHAN, ASSISTANT COMPTROLLER GENERAL, NATIONAL SECURITY AND INTERNATIONAL AFFAIRS DIVISION, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY ROBERT P. KISSEL AND DANIEL J. HAUSER, CINCINNATI REGIONAL OFFICE, GENERAL ACCOUNTING OFFICE

Mr. CONAHAN. Thank you, Mr. Chairman, Senator Thurmond.

With me on my right is Bob Kissel, who is a manager out of our Cincinnati Regional Office, and who has been associated with our strategic bomber program work for the past several years. And on my left is Dan Hauser, who has been directly involved in the study of the B–1B program for several years, and who will continue on in any remaining work.

I would like to pretty much proceed through my statement. I think it covers the points that you asked that we cover, and I think that it answers a number of questions that you asked be answered. There are three sentences in here I believe that relate to fuel leaks, Mr. Chairman, and I will completely avoid them.

Senator EXON. We understand that.

Mr. CONAHAN. The B–1B program today has performance problems that restrict its intended mission capability. These problems resurfaced during the test program, but testing is incomplete in im-

portant areas, and the development and test program has been extended.

The Air Force believes it has identified solutions to known performance problems. In our view, assurances that problems have been solved must await the successful completion of the test program. I think that this has been borne out by the history of this program to date.

Testing is now scheduled to be completed in February, 1989, and fixes to the problem are scheduled to be completed in January 1991. A little background.

When the decision to procure the B-1B was made in October 1981, an initial operational capability of October 1, 1986, was set. That capability was defined as delivery of the 15th aircraft to the Strategic Air Command with sufficient support resources to carry out their mission. The October 1986 date was considered achievable because of the experience gained in the earlier B-1A program.

It was recognized that achieving it would require a high degree of concurrency between development and production and in fact some development and production contracts were signed on the same day. The IOC date also compressed the test program due to the short period of time available for conducting tests. The program costs were capped by the Congress, and the President certified in writing that the program could be completed within that estimate.

Over a third of the 100 planned aircraft have been delivered, and the final B-1B is scheduled for delivery in April 1988.

Despite production delivery successes, the performance has been consistently less than originally intended. [Deleted.]

They also reported that the weapons delivery and offensive systems would not have full capability as of that time. The report listed a variety of performance, logistics, and other problems, several of which remain today.

Developmental and production problems in B-1B subsystems have limited testing of the system and have necessitated operational restrictions in critical areas that limit the effectiveness of the aircraft, and prevent some operational training.

While a lot of testing has taken place, it is incomplete in many important areas. Problems have prevented crew training at the low altitudes critical to the B-1B penetration of hostile air space. Also, problems with the defensive avionic systems have prevented testing of the full system. Let me deal briefly with some of these problems insofar as the flight control is concerned.

The B-1B is currently restricted from using its full-flight capability at required gross weights and altitudes. Generally speaking, an aircraft becomes increasingly hard to handle, and often will vibrate or wobble in flight as it approaches the limits of its flight envelope. This warns the pilot, and action can be taken before control is lost.

The B-1B does not behave in that manner as it approaches these limits. To ensure safety, an alarm system has been installed in the B-1B to warn pilots when they approach 80 percent of the flight envelope. Pilots are instructed to go no further. If they follow these instructions, the B-1B is restricted to 80 percent of its design flight envelope.

A second phase of that system is being installed which will permit the pilot to go to 95 percent of the flight envelope. We believe that those systems are proceeding.

Just a word about the terrain-following radar. Problems with the terrain-following radar restricted its testing and delayed its use in crew training. The B–1B is intended to fly at [deleted] over rolling terrain at night in all weather at a gross weight of [deleted] pounds.

Problem correction is underway, and permission has been granted to use terrain following at [deleted] feet during daytime and at fair weather at a gross weigh of 280,000 pounds, all of those considerably below design.

Before the terrain following can be used, current system software must be upgraded. As of March 24, five B–1Bs at Dyess Air Force Base had the necessary software.

Now about the defensive systems. The plane's effectiveness is further limited by the poor performance of the ALQ–161A defensive system, which is critical to the survivability of the aircraft.

Development and production problems delay delivery of system components. Once components were available, testing identified many performance problems, and these problems are preventing operation of a complete defensive system for the airplane.

The Air Force has outlined a three-phase modification plan to fix the system, but completion of the plan is not scheduled until 1991. The first phase established the common configuration called MOD Zero. This phase began testing in January 1987.

In early 1988, the Air Force plans to begin changing some circuit cards and software in the B–1B fleet to update the defensive system to a MOD–1 configuration. This modification is an interim step in getting to contractual specification and has capabilities for new threats.

A retrofit to a MOD–2 configuration, or a third modification, will give the B–1B a system that meets specifications. The cost to the Air Force of retrofitting these modifications is estimated at a little over $400 million. The defensive system contractors told us that they had experience in developing electronic warfare systems, but had limited experience in the high-volume production necessary for the B–1B program.

The contractor underestimated the complexity in designing and manufacturing the system, and development and production delays have been with the program since the beginning. This limited the availability of hardware for testing.

Flight testing completed to date has identified problems with the system. Also, according to the Air Force, the problems occur intermittently, which increases the difficulty in pinpointing the cause. This has been a particularly difficult problem for the Air Force.

Let me talk about the avionic integration. The offensive and defensive avionics have interfered with each other. While the potential for interference is not unusual at this stage, avionics integration was intended to be completed by the IOC.

Completing the integration effort requires a highly complex development effort and extensive testing. Testing did not begin until June 1986, and will continue as avionic components become available.

As I mentioned, inasmuch as we are not going to have the defensive systems available for some time, that integration simply cannot take place.

Let me say a word about schedule. A significant portion of the combined development and operational test and evaluation, as I said, has yet to be accomplished. It has been extended by 32 months, and is now planned to be completed by February 1989. This is 8 months after all the B–1Bs are scheduled to be fielded.

The extended test schedule is also optimistic. It allows no time to correct or retest deficiencies that may occur, and there is little time for canceled test flights and mission aborts caused by inclement weather or aircraft or instrumentation unavailability.

To date, they have been able to carry out about 62 percent of the scheduled tests. The plan program calls for 75 percent success rate in doing tests. Therefore, future testing will have to be more successful than past testing.

Once flight testing is successfully completed, fixes must be incorporated on all aircraft. The current flight test milestones and schedule completion of retrofit for critical performance is shown in a table that we have on page 8 of our statement, Mr. Chairman. As I mentioned, the fixes go up through January of 1991, and they relate to the defensive avionics systems.

The statement that we submitted for the record does talk about some logistics problems that are taking place with respect to the aircraft and the impact on their availability of the aircraft. I will not go into that at the moment.

Insofar as cost is concerned, we all know that the program was capped at $20.5 billion in fiscal year 1981 dollars. The Air Force calculates that it will complete the baseline program within a $20.4 billion ceiling. In fiscal year 1986, Congress reduced the original funding requirements by $1.3 billion on the basis of savings, you will recall.

The Air Force plans to come in and ask for restoration of perhaps all of that. The current budget requests a total of $802 million for the program in fiscal years 1988 and 1989. Of this, $600 million is needed principally to cover the extended flight test program and represents a partial restoration of the fiscal year 1986 reduction.

A program office official told us that restoration of the remaining cut may be needed to fund contract overruns and new tests, and a fiscal year 1988 supplemental may be required. Our more recent information is that they likely will come in with a supplemental.

The $802 million request also contains $200 million, which represents the initial funding for three capability enhancements that the program office estimates will eventually cost over $1.5 billion. These are for a forward-looking infrared sensor, for a standard weapons' interface system, and $130 million to upgrade the ALQ–161 defensive avionics system beyond where the initial contract specification called for it to be.

In addition, other capabilities will have to be added. For example, the program office is currently defining a modification to the ALQ–161 to enhance countermeasures against [deleted] threat radars. The Air Force estimates the cost of this enhancement at about $1 billion.

Also, other enhancements will be required to incorporate planned programs such as MILSTAR, the GPS Navigation System, Nuclear Safety Devices, and classified weapons currently under development. None of these enhancements are currently in the program.

Although the aircraft is currently characterized by the Air Force as on alert, as of this week only one aircraft was standing routine SIOP alert. The Air Force has stated that the remaining aircraft could perform SIOP missions in the event of war.

While SAC can assign SIOP missions, the B–1B can be expected to perform within its current limitations, these are likely not the same missions that would be flown if full design capability was available.

The limited opportunities for operation of crew training and low-altitude operations and defensive capabilities, in our view, is a continuing problem. If the B–1B had to fly a SIOP mission today, it would have to fly shorter missions. [Deleted.]

Currently, the B–1B defensive avionics can alert the crew if an enemy radar is searching for the aircraft and [deleted].

Although there have been schedule problems with nuclear certification, limited certification has been completed for several weapons from the middle and aft bays, and these are outlined in our statement.

As discussed previously, even if current plans to correct B–1B problems are fully successful, it will be early 1991 before the intended performance is available on all aircraft.

In closing, Mr. Chairman, there were a number of unique features with respect to this program. They had to do with the early IOC, the congressional cost cap, the Presidential certification, and the Air Force assuming management responsibility for integration.

In our view, however, the one item that impacted on the current situation more than anything else was the concurrency feature, the high concurrency feature of this program, one that I think needs to be explored in any future program that we might undertake.

That covers our prepared statement, Mr. Chairman. I would be happy to take whatever questions you might have.

[The prepared statement of Mr. Conahan follows:]

PREPARED STATEMENT OF FRANK C. CONAHAN, ASSISTANT COMPTROLLER GENERAL OF THE UNITED STATES

THE B–1B AIRCRAFT PROGRAM

Mr. Chairman and members of the subcommittee:

I am pleased to be here today to discuss cost, schedule, performance, and other aspects of the B–1B program. Our observations are different in several respects from the information presented by the Air Force in testimony given to this committee on February 23, 1987. I believe our testimony is a realistic assessment of the status of the program as it exists today.

The B–1B today has performance problems that restrict its intended mission capability. These problems were surfaced during the test program, but testing is incomplete in important areas, and the development and test program has been extended. The Air Force believes it has identified solutions to known performance problems. In our view, assurances that problems have been solved must await the successful completion of the test program. Testing is now scheduled to be completed in February 1989 and fixes to the problems are scheduled to be completed in January 1991.

BACKGROUND

When the decision to procure the B–1B was made in October 1981, an Initial Operational Capability (IOC) of October 1, 1986, was set. IOC was defined as delivery of the fifteenth aircraft to the Strategic Air Command with sufficient support resources to carry out their mission. The October 1986 date was considered achievable because of experience gained in the earlier B–1A program. It was recognized that achieving it would require a high degree of concurrency between development and production and, in fact, some development and production contracts were signed on the same day. The IOC date also compressed the test program due to the short period of time available for conducting tests. Program costs were capped by the Congress, and the President certified in writing that the program could be completed within the estimate.

Over a third of the 100 planned aircraft have been delivered, and the final B–1B is scheduled for delivery in April 1988.

PERFORMANCE

Despite production delivery successes, the performance has been considerably less than originally intended. [Deleted.] They also reported that its weapons delivery and offensive systems would not have full capability at IOC. The report listed a variety of performance, logistics, and other problems, several of which remain today.

Developmental and production problems in B–1B subsystems have limited testing of the system, and have necessitated operational restrictions in critical areas that limit the effectiveness of the aircraft and prevent some operational training. While a lot of testing has taken place, it is incomplete in many important areas. Problems have prevented crew training at the low altitudes critical to B–1B penetration of hostile airspace. Also problems with the defensive avionics system have prevented testing of the full system. Let me deal briefly with some of the problem.

FLIGHT CONTROLS

The B–1B is currently restricted from using its full flight capability at required gross weights and altitudes. Generally speaking, an aircraft becomes increasingly hard to handle and often will vibrate or wobble in flight as it approaches the limits of its flight envelope. This warns the pilot, and action can be taken before control is lost. The B–1B does not vibrate or wobble as it approaches these limits.

To ensure safety, an alarm system has been installed in the B–1B to warn pilots when they approach 80 percent of the flight envelope limit. Pilots are instructed to go no further. If they follow these instructions, the B–1B is restricted to 80 percent of its designed flight envelope.

A second phase of the system called the Stall Inhibitor System, is planned to allow the pilot to use 95 percent of the flight envelope and preclude exceeding that limit. The final stage, called a Stability Enhancement Function, is planned to give the B–1B even greater capability. According to Strategic Air Command (SAC) projections, on a representative mission, the Stall Inhibitor System will improve B–1B low-level penetration range from [deleted] and the Stability Enhancement Function will increase this to [deleted].

The Air Force currently plans to allow use of the Stall Inhibitor System by June 1987, and the Stability Enhancement Function by June 1989.

TERRAIN FOLLOWING RADAR

Problems with the terrain-following radar restricted its testing, and delayed its use in crew training. The B–1B is intended to fly at [deleted] over rolling terrain at night and in all weather at a gross weight of [deleted] pounds. Problem correction is underway, and permission has been granted to use terrain following at [deleted] feet during daytime and in fair weather at a gross weight of 280,000 pounds. Before the terrain following can be used however, current systems software must be updated. As of March 24, five B–1Bs at Dyess Air Force Base had the necessary software.

DEFENSIVE SYSTEMS

B–1B effectiveness is further limited by the poor performance of the ALQ–161A defensive system, which is critical to the survivability of the aircraft. Development and production problems delayed delivery of system components. Once components were available, testing identified many performance problems. These problems are preventing operation of a complete defensive system for the B–1B.

The Air Force has outlined a three-phase modification plan to fix the system, but completion of the plan is not scheduled until 1991. The first phase established a common configuration called MOD O. This phase began testing in January 1987.

In early 1988, the Air Force plans to begin changing some circuit cards and software in the B-1B fleet to update the defensive system to a MOD 1 configuration. This modification is an interim step in getting to contractual specification and adds capabilities for new threats.

A retrofit to a MOD 2 configuration will give the B-1B a system that fully meets the specification. The cost of the Air Force of retrofitting these modifications is estimated at $400.3 million.

The defensive system contractor told us they had experience in developing electronic warface systems, but had limited experience in the high volume production necessary for the B-1B program. The contractor underestimated the complexity of designing and manufacturing the system, and development and production delays have been with the program since the beginning. This limited the availability of hardware for testing.

Flight testing completed to date has identified problems with the integrated system. Also, according to the Air Force, the problems occur intermittently which increases the difficulty in pinpointing the causes.

AVIONIC INTEGRATION

B-1B offensive and defensive avionics have interfered with each other. While the potential for interference is not unusual at this stage of avionics development, avionics integration was intended to be complete by IOC. Completing the integration effort requires a highly complex development effort and extensive testing. Testing did not begin until June 1986 and will continue as avionics components become available. Until the complete defensive avionics system is available for test, it is not possible to estimate when this effort will be completed.

FUEL LEAKS

Finally, the aircraft are still experiencing fuel leaks. Although such leaks would not prevent use of the B-1B in the event of war, they do restrict its use and limit operational crew training. The seriousness of this situation does not approach the problems noted above.

SCHEDULE

A significant portion of the combined development and operational test and evaluation is yet to be accomplished. It has been extended by 32 months and is now planned to be completed by February 1989. This is 8 months after all B-1Bs are scheduled to be fielded.

The extended test schedule is highly optimistic. It allows (1) no time to correct and retest major performance deficiencies that may occur and (2) little time for cancelled test flights and mission aborts caused by inclement weather or aircraft and instrumentation malfunctions. To date, for one reason or another, the B-1B has completed only 62 percent of scheduled tests.

The extended test schedule assumes a 75 percent success rate with no allowance for resolution of problems that may yet occur. Therefore, future testing will have to be more successful than past testing. The current schedule also assumes successful completion of the development of fixes for the problems discussed above.

Once flight test is successfully completed, fixes must be incorporated on all aircraft. The current flight test milestones and scheduled completion of retrofit for critical performance problems are shown below:

B-1B TEST SCHEDULE MILESTONES AND RETROFIT SCHEDULE

	Test schedule		Retrofit schedule	
	Start	Complete	Start	Complete
Flight Controls:				
Stall Inhibitor	December 1986	June 1988	March 1987	December 1987.
Stability Enhancement	May 1987	February 1989	March 1988	Undetermined.
Defensive Avionics:				
Mod 0	January 1987	June 1987	January 1987	December 1988.
Mod 1	April 1987	September 1987	January 1988	December 1988.

B–1B TEST SCHEDULE MILESTONES AND RETROFIT SCHEDULE—Continued

	Test schedule		Retrofit schedule	
	Start	Complete	Start	Complete
Mod 2	April 1987	September 1988	June 1989	January 1991.
Tail Warning Function:				
Phase 1	February 1987	April 1987	August 1987	April 1989.
Phase 2	October 1987	March 1988	September 1988	May 1990.

LOGISTICS

Twenty-six B–1Bs have been delivered to Dyess Air Force Base. Ellsworth received its first aircraft in January 1987 and is scheduled to receive a total of 35 during the year. Major logistics and support problems have developed at Dyess. The lack of spare parts and inadequate repair instructions has already impacted on the availability of the fleet. On March 31, six of the aircraft at Dyess were not operational for one reason or another, including three aircraft which were cannibalized to provide spare parts for other aircraft.

COST

The B–1B baseline program is capped at $20.5 billion in fiscal year 1981 dollars. The program office calculates the cost to complete the baseline program will be $20.4 billion in FY 1981 dollars. This would be within the $20.5 billion base year dollar estimate certified by the President in 1981. In fiscal year 1986, Congress reduced the original funding requirements by $1.3 billion. The program office calculation anticipates full restoration of the fiscal year 1986 budget cuts. However, because current problems must be corrected and significant development and testing remain to be completed, there is no assurance that the baseline program can be kept at or under current estimates.

The current budget requests a total of $802 million dollars for the program in fiscal years 1988 and 1989. Of this, $600 million is needed principally to cover the extended flight test program, and represents a partial restoration of the FY 1986 reduction. A program official told us that restoration of the remaining FY 1986 cut may be needed to fund contract overruns and new tasks, and a FY 1988 supplemental may be required to provide these funds.

The $802 million request also contains $200 million which represents the initial funding for three capability enhancements that the program office estimates will eventually cost over $1.5 billion. These are: $665.3 million for a forward-looking infrared sensor, $787.6 million for the addition of a weapons interface necessary to enable the B–1B to carry the new SRAM–II missile, and $130.0 million to upgrade the ALQ–161A defensive avionics system.

In addition, other capabilities will have to be added to the B–1B if it is to be an effective penetrator through the 1990s. For example, the program office is currently defining a modification to the ALQ–161A to enhance the countermeasures against [deleted] threat radars. The program office estimated the cost of this enhancement at $999 million dollars.

Other enhancements will be required to incorporate planned programs such as the MILSTAR communications system, GPS navigation system, nuclear safety devices, and classified weapons currently under development. None of these enhancements has been formally added to the program, and are not included in program costs.

MISSION EFFECTIVENESS

Although the B–1B aircraft is currently characterized by the Air Force as on alert, as of March 30, only one aircraft was standing routine SIOP alert. The Air Force has stated that remaining aircraft could perform SIOP missions in the event of war. While Strategic Air Command can assign SIOP missions that the B–1B can be expected to perform within its current limitations, these may not be the same missions that would be flown if full design capability was available.

The limited opportunities for operational crew training in low altitude operations and defensive capabilities may further reduce mission effectiveness even on these limited missions.

If the B-1B had to fly a SIOP mission today, it would have to fly shorter missions. [Deleted].

Currently, B-1B defensive avionics can (1) alert the crew if an enemy radar is searching for the aircraft and (2) [deleted].

Although there have been schedule problems with nuclear certification, limited certification has been completed for several weapons from the middle and AFT bomb bays. The B-1B is currently certified to carry nuclear bombs (B-61 and B-83) in these bays. The forward bay is scheduled to be certified for both bombs and the Short Range Attack Missile (SRAM-A) in May 1987. Turbulence problems have delayed certification of SRAM-A in the rear bay. Flight testing of conventional weapon release is scheduled for completion by the end of 1987.

As discussed previously, even if current plans to correct B-1B problems are fully successful, it will be early 1991 before the intended performance is available on all aircraft.

LESSONS LEARNED

In closing, Mr. Chairman, let me say that the initial ground rules of the B-1B program established a severe management challenge for the Air Force. The program included many unique factors such as the early IOC, the congressional cost cap and presidential certification, the Air Force assuming responsibility for airframe and avionics integration, multiyear contracting, and an absence of some of the oversight normally available through milestone program reviews.

These factors are interrelated, and it is likely each has had some impact on current program problems. Our work, however, indicates that the high degree of concurrency between development, production, and testing was a major contributor to all the present problems.

At this time, I would be happy to answer any questions you may have.

Senator EXON. Mr. Conahan, thank you very much. I think you were right on the mark answering the points that we raised.

Let me ask a general question. I had reservations, as one Senator, about the B-1B program, and then decided the B-1B was a necessary addition to our force, so long as we would limit it to 100 airplanes.

We had extensive testimony in both open and closed session on the penetrating ability of the B-1. There was a shortcoming to the program from the very beginning. I was always fearful of that, that it was being oversold as a penetrator. In fact, we had open testimony one day from the Secretary of Defense that the B-1 would be a penetrator only until 1991, or about 1991. That was the general context of his reply.

Then, afterwards, he came back and said, well, no, it would probably be the mid to the late 1990s. At least when I voted for the B-1B, I never felt that it was going to be a penetrator for long certainly for not beyond 1991, given what we thought might be the Soviet improvements in radar detection.

So I primarily based my justification for voting for the B-1 due to the fact that I was not sure that the ATB would be on line by that time, and I felt that the B-1B could supplement our existing bombers. That was my reasoning and rationale.

Be frank with me. Was that sound reasoning on my part? From the shortcomings that have developed, do you feel that the B-1B still can play an important role as a conventional or stand-off bomber, if not a penetrating bomber?

Mr. CONAHAN. I think that the mission of our strategic bombers continues to change. We had the B-52 with a particular mission, and then in more recent years its mission changed somewhat, and to some extent it too performed a penetrating role.

I think that the B–1 was to be the principal penetrator during a period beginning sometime in the late 1980s until the early 1990s. I think the important point to be made right now is that, whereas one felt that 1991 was going to be the end of the period when it was going to have a penetration mission, that is about the beginning of the period when it can have a full penetration mission now. Because the last aircraft under the current schedule is not scheduled for the necessary refits until the early 1991 period.

Chairman NUNN [presiding]. So what you are saying, if I understand, is we have to really decide pretty soon whether we want to pursue the penetrating role of the B–1 and sink a lot more money into possibly curing the problems that prevent that. Is that what you are saying?

Mr. CONAHAN. I am saying that I do not—yes, sir. I do not think that the Air Force today is in a position to tell us whether or not it will be able to bring off the fixes that are necessary for it to do that mission by the time that its current schedule says so. I think that is the decision that has to be made.

The Air Force believes that it can do that, but——

Chairman NUNN. What do they define—what do you define, if there is a difference—as the capability required to truly call it a penetrator? You see these charts and you see the percentages on the charts that they have accomplished based on what they thought they were going to accomplish, but nobody will say what it really takes to be a penetrator, that you really send men in to perform the mission. What is the definition of successful penetration that we have to shoot for?

Mr. CONAHAN. Well, I think that we have to look at that in two ways. First of all, we need to take a look at the offensive avionics. We have to take a look at the terrain-following capabilities. Based on everything that we have seen, it appears that they will be able to bring those up to the speed necessary in order for the offensive avionics to work.

Right now they contend that they could do it in a war-time mission. However, the pilots are under instructions not to go below 500 feet at the moment. One concern that we would have in that regard is that even if the airplane could do it, crews will not have been trained at any point in order to do that mission at 200 feet.

The most important point has to do with the defensive avionics. [Deleted.]

That is the problem that escapes solution for the moment. The problems have been identified, and there are a series of problems that have been identified, very technical problems. The contractor has been tasked to find a solution for those problems. The contractor has come forward with proposed solutions for several of the individual technical problems, but the Air Force has not agreed that they are the solutions, and has turned the contractor back to come forward with new solutions.

Chairman NUNN. Why do you disagree with the Air Force?

Mr. CONAHAN. Why do we disagree with the Air Force? I only disagree with the Air Force in terms of their characterization of the fact that they now have a solution for the problems that exist. I think what they have done is that they have identified the problems, and they are working on a solution.

Chairman NUNN. Do you think we ought to, in your own view—I am not asking you necessarily to speak for the agency—put the money in that they are requesting this year, if you were over here on my side of the decision making?

Mr. CONAHAN. Yes. I think that we need to permit them to make the fixes. Now they are asking for two things. They are asking for $800 million this year. $600 million of that is going to fund the continuing test and evaluation program. In fact, part of it has already been spent, but it is for test and evaluation.

I think that that is probably a good investment. We have very close to $28 billion already committed to this airplane. There is very little question out there on the airframe, the engines, and as I said I think a lot of the other problems they have had such as terrain following and some of those other things are very, very close to being worked out.

The single remaining problem is the defensive avionics. With that kind of an investment, it seems to me that we can probably afford the $600 million that they are asking to fix that.

The other $200 million is a down payment for the enhancements systems for the aircraft, and I do not see that those systems are at all time critical. I am not really sure why we would want to begin buying into expensive enhancements to that airplane until we see if we can take care of the fundamental mission requirements.

PROGRESS ON AVIONIC SYSTEM

Chairman NUNN. How do we tell if we are really making progress on the avionics system?

Mr. CONAHAN. I think that we need a closer monitoring of what the Air Force and the contractor are doing. You know, until a few months back, we were hearing that this program was in very good shape and there were very few problems with the program.

We saw some press reports of fuel leaks, an things like that, which are fairly minor and common to most new aircraft programs. We were asked sometime back to go in and take a close look at it. I think perhaps that our getting involved with the committee staffs had an awful lot to do with putting on the table the real situation as its exists today.

I think that what you could do is to ask our organization to continue to monitor what the Air Force and the contractors are doing. We have a capability of doing that, and I think that monthly, quarterly, or what have you, we could come up and report to you on how we see that going.

Chairman NUNN. That is a good suggestion. We will take you up on that.

COST CAPS

What role did cost caps play in this? Are you basically saying it was a negative factor and we should avoid cost caps?

Mr. CONAHAN. No, I do not think that the cost cap was a paramount contributor to the problems here. I think that it did contribute. For example, it forced the Air Force into doing some things it would not otherwise do, and we can talk about the consequences of that.

For example, they took some things out of the airplane before they went forward with the program at $20.5 billion that were in earlier designs of the airplane. As a matter of fact, one of them is the one that they are coming in for now as an enhancement, that standardized electronic package.

That was in the original specifications, but in order to come in under $20.5 billion, they took that out. Now they say that they need to put it in to enhance the airplane. I think there will be an argument out there somewhere down the road, although I am not prepared to engage in that argument right now, as to whether that is indeed necessary in order for the plane to do its mission. So they did that sort of thing.

The Air Force did some other things. They took items out of the program that ordinarily would be included in the program. This is only bookkeeping. For example, they took simulators and interim contractor support out of their cost estimate and that is being accounted for separately. You might say that is only an accounting problem, but it certainly makes more difficult the overall problem of managing the program.

Chairman NUNN. You are basically saying that is a way of avoiding the law; right?

Mr. CONAHAN. I am saying that ordinarily those things would be included in the cost of the program.

Senator WARNER. Are you going up to the White House? I wonder if I could get in one or two questions?

Chairman NUNN. Absolutely.

Senator WARNER. I appreciate that.

Mr. Chairman, I must tell you and my other colleagues that there may be two failures here. One is a failure by Congress to spot this problem. And, while I will not be present when the next panel comes up that will address the management review, I am just as concerned about the deficiencies in the aircraft as I am about the inability of the various oversight procedures—namely that of the Congress, and that of the Department of Defense—who evidently had a little early warning here.

Would you be able to comment on that? We have got to go back and see what we, the Congress, did by virtue of our failure to detect this, and hopefully to eliminate that same problem in another program, for example the ATB. That would be my second question.

So my question to you is, can you give us any guidance on where it is the Congress erred in not picking this up?

Mr. CONAHAN. Well, I think what happened at the outset is that both the Congress and the administration bought into a program based on some very generalized objectives and parameters. I think that what we should have had at that time was a much better understanding between the Congress and between the administration as to what this bomber was going to do, and what precisely its mission design capabilities were going to be.

In the absence of that, the Air Force was permitted throughout the life of this program to contend good success with the program. There was no criteria there, if you will, to challenge that until the very end when the problems became so great that it was difficult in any way to suggest that these were anticipated or expected. So I

think that is one thing. I think we have to reach some kind of criteria.

Second, I do believe that the committees need to monitor these type programs a little more closely than this one was monitored. If you recall——

Senator WARNER. I have been here for 8 years with my distinguished colleagues, and I think we both started on the committee with Bill Cohen. Is that not correct?

Senator EXON [presiding]. Yes.

Senator WARNER. And the two of us have sat here, and I say this respectfully, in modesty, maybe, but we have worked as hard as anybody I know to monitor all these programs, and here we are learning these facts 8 years after the program was first canceled and rejuvenated.

Now we have got to determine where the Congress failed in its role of detecting the problem.

So, as I said earlier, Mr. Chairman, while I am concerned about the effective problems with this airplane, I am also concerned about frankly the failure in the Congress to exercise its proper role of oversight and perhaps be alert to this problem.

I must say that I am going to independently look into which officers of the Department and the Air Force need to come up here and testify, and to make certain that there was no deliberate misleading of the Congress. This greatly concerns me.

Now perhaps you are not in a position to answer these questions, but I intend to probe around and see what I can do.

Have we learned any lessons from this that we should apply to the ATB?

Mr. CONAHAN. Oh, I think, Senator Warner, indeed we have. I think that we should look very, very closely at the management structure that is in place for the ATB, and that will be put in place as that program continues to grow.

It is kind of interesting. When we first got——

Senator WARNER. I am afraid I simply have to leave for another engagement.

Mr. CONAHAN. But that is a good point, and we testified before the House earlier this week on that program. I think that it might be well if this committee could find a short period of time for us to discuss it with them, because you see very similar problems there.

Senator WARNER. Thank you. And if anyone in this room has some thoughts to my question, please contact me formally, or informally, or any way you wish.

Thank you, Mr. Chairman.

Senator EXON. Senator Warner, thank you. I just want to associate myself with the remarks that you made. We are disappointed, I think. I guess our degree of disappointment is somewhat that we felt that maybe we had not conducted ourselves as well on this as we should, and that is why we are very pleased that you have come over here this morning to give us in detail your thoughts.

I am sorry that I had to take a call just as you were answering my question. I had been briefed on your answer, Mr. Conahan.

What is your advice to us—that we should provide no additional money for providing a fix-up of the electronic system and continue the B–1B as though it probably was always an interim bomber? Is

that your recommendation to us? Should we put some money into it?

And the last part of that question, to tie it all together, it seems to me, is the question of do we need to put more money into this aircraft to make it perform acceptably as a conventional bomber? Or would it perform adequately today as a conventional and stand-off bomber and a cruise missile carrier?

Mr. CONAHAN. I guess we would have to reach some definition on what we mean by a conventional bomber. If we are talking about a conventional bomber with a penetration role, [deleted].

PENETRATION

Senator EXON. Well, let us define "penetration." When I talk of penetration, I talk of penetration into Soviet defenses, deep into Soviet territory to delivery payloads on highly important targets. That is what I call penetration. There is also penetration that you are going to have to go through in conventional warfare.

When you talk about penetration, are you talking my definition of penetration?

Mr. CONAHAN. Well, let me talk to your definition of penetration. On your definition, [deleted], primarily, though not exclusively, because of the defensive avionics problems. Now I think what we need to do is to take a look at what the Air Force currently estimates is required to fix that, in order for the B-1B to perform its penetration role.

It is estimated that the fixes to the defensive avionics system will cost something on the order of $400 million. Now this is on top of something like $3 billion for that system, which is part of something on the order of about $28 billion that we have already committed for this airplane.

The Air Force believes it has found the solutions. Our position is that it has found the problem. It has asked the contractor to come up with solutions and is currently working with the contractor to do so.

If the Air Force can bring it off for $400 million, plus another $130 million—which I can talk about in a moment—if they can bring it off based on the investment we have there right now, it seems to me that were I voting I would vote for it. But I would also put in place some sort of a mechanism where I would have assurances on a periodic basis—every month, or 3 months, probably, or better, in a report on how well they are going in that regard—so that we do not get to the end of the period and the Air Force comes back to say they did not make the fix and now need another $400 million or $800 million or $1 billion.

I think that that is where I would come out in terms of spending the $400 million.

Now they have also asked for other funds. They have asked for initial funding for enhancements to this airplane which they currently estimate would cost about $1.5 billion. Then on top of that, they are talking about a further enhancement for another billion dollars.

I do not see anything time critical about those enhancements to this aircraft, and thus I do not think I would be forthcoming for

the funding for those. But I would, I think, vote yes on the $400 million.

Senator EXON. OK, that is a fair answer.

What about the option? I am becoming more and more convinced that the Air Force continually overplays the role that this aircraft can affordably play in the next 6 years with regard to penetration. I told you what my evaluation was when I voted for the B–1B. I do not think that has ever been the Air Force's view. I think the Air Force is determined to make this airplane a penetrator that they originally thought it was when we first began to hear about the B–1.

What would happen, and how good would that aircraft be, if we said no more money? No more money. You bought the airplane. You designed the airplane. You accepted delivery of the airplane. You have some more coming on line. You use that airplane just like it is now as best you can use it.

What is the answer to that? I suppose you might say, yes, except that if they could do what they think they could do for the additional $500 million plus, then I guess what you are saying is that that would be a good investment?

Mr. CONAHAN. Well, we can certainly envision a standoff mission for it for the delivery of cruise missiles. It can do that now, with some—it still requires some fix even——

Senator EXON. Even to do that?

Mr. CONAHAN. Even to do that. But when we are as close as we are to achieving the penetration role, I think we need to hear out the Air Force. But I think that they do need to convince us, because they have been very generalized in what they held out this airplane could do in the past, or what it would do, and even their current statements that they have solutions are not in our view really accurate.

We think that they need to develop those solutions, and we think they need to be tested.

Senator EXON. In answer to a question from Senator Warner, you indicated that there was some concern about ECM as it relates to the ATB; specifically whether or not those same lessons could be helpful to us and keep us out of similar pitfalls in the future. Yet many of us do not see the relevancy to the current concerns of the Chairman of the House Armed Services Committee, because [deleted].

Moreover, the second most likely area for concurrency problems in aircraft is in the engine program, and yet the [deleted]. I would hope that you would answer that question.

Do you see concurrency, then, as much of a major problem with the ATB as it has obviously been with the B–1B? If so, what particular areas would concern you?

Mr. CONAHAN. Let me answer that as follows: In our assessment of the program there is not as much concurrency in the ATB program as there had been in the B–1B program. Therefore, I do not believe it would be as much of a problem in this program.

However, I think that we need to get into a different forum to discuss the [deleted]. I do not think that we can really have a meaningful discussion of that matter here because of the classifica-

tion associated with it, and I would defer to another session on that particular matter.

Senator EXON. Would you describe the Air Force estimate of the $600 million, and the one-and-a-half-year fix for the B–1B ECM system as high risk as far as being successful, medium risk, or low risk?

Mr. CONAHAN. I think it is a ghost toward the high risk. The contractor has had difficulties right from the very beginning in performing under its contract. The Air Force has identified a very large number of deficiencies in the defensive avionics systems. It has been working with the contractor for some time to try and get fixes for them. The problems are fairly well delineated. The contractor has come forward with some proposed fixes that it and the Air Force ultimately agreed were not fixes. The Air Force sent them back to the contractor and the contractor is coming forward.

There are a large number of those problems. Each has to be tested. The test schedule does not provide an awful lot of leeway for retesting or for making up tests that cannot be done for reasons that are nontechnical in nature, such as weather and nonavailability of equipment.

So I think if you wrap that all together, there is a fairly high level of risk, particularly in terms of your wedding it to the date in the short term. I think if you give them enough time, they can fix anything. With time and money, you can fix just about anything. But I do think it is high risk.

Senator EXON. To what extent was the role of the Air Force as a prime contractor to blame for the lack of warning of trouble on the B–1B aircraft?

Mr. CONAHAN. I think it clearly has been a factor in this program. I do not know that I can say that the Air Force did not have the technical ability to carry this out, but it watched itself. You know, when there is a prime contractor, responsible for bringing these things together, the Air Force can stay on top of the prime contractor. In this case, the Air Force was the prime contractor. There was no one there bringing pressure on the Air Force to perform, so it could pretty much call its own shots. I think that that was a problem. Now that is not to say that the Air Force has not been successful as being the integrator of some other programs. As you know, on some of the ICBM programs the Air Force was the integrator in the absence of a prime contractor, and they seemed to have worked out certainly a lot better than this program.

But I think in this program that was a problem.

In talking about the ATB, when we first looked at that progam, we found, although there is a prime contractor there, that the Air Force management structure was pretty slim and that the hierarchy of the Air Force did not have in place a structure which would have called for the kind of monitoring that we thought was required. Now we see a lot of movement in that, and I suspect that the dialogue over the B–1B has had a lot to do with that, too.

Senator EXON. Mr. Conahan, I believe that we have covered probably the primary questions that we might have. Other than maybe one last, all-encompassing one.

COMPARING B–1B DEVELOPMENT PROGRAM

When you ask these kinds of questions, I know it is very hard for you to be specific, but on a scale of 1 to 10, 10 being the highest and 1 being the lowest rating, how would you compare the B–1B development program with the other major aircraft acquisition programs that you or your associates might be familiar with? I would just name a few, to give you an idea, and any others you might add: The C–5A, the F–16, the F–15, and so forth.

We have had a lot of experience, but we have never had an aircraft I suspect that we have developed right on schedule without any problems. But if we had such an aircraft system that worked, that would be 10. Generally speaking on a scale of 1 to 10, what would be the norm for problems on aircraft? And with the ones that I have mentioned and others you might have in mind, how would you rate this one? I am trying to get, how bad off are we compared to what we have done in the past.

Mr. CONAHAN. I guess what I need to do, Mr. Chairman, is to look at the programs and their components. Also, the B–1 program is a very unique program. When did it start? Did it start back with the B–1A? Or did it start with the B–1B? First of all, we have to reach some agreement on that.

But if it started with the B–1B, insofar as the air frame and the engines were concerned, that should have gone right along, and it probably did go right along. Insofar as the new avionics packages were concerned, that is an all together different matter. If you compare the development of the avionics here with the FB–111, or other avionics packages, it is somewhere in that ballpark. As you know, I am not going to give you a "1" or a "10."

Senator EXON. I was afraid you would not.

Mr. CONAHAN. But I do think that we need to take a look at it that way. I think all these programs should be looked at that way, and again comparing with the ATB I think we should do that. We can break that down and say, how much concurrency is reasonable in terms of what we know about that airplane and what we do not know about it.

Senator EXON. I listened very carefully a few moments ago when you said, if we do go ahead with more funds to do the fixup on the whole series of problems that the Air Force has identified belatedly at least, you indicated that you would think that we should require a report from them every 30 or 60 days?

Mr. CONAHAN. Sixty or 90 days.

Senator EXON. Put some conditions on the money—that they cannot spend any more money until they come back and convince us that they have gone this far? Are those some of the things you are thinking about?

Mr. CONAHAN. Well, I think that the Air Force is going to cry "micro management" when you do that, but it seems to me——

Senator EXON. Well, they have always done that. As much as we all hate micro management, I gather what we are saying around here this morning is that we should have a little more micro management on these programs, should we not?

Mr. CONAHAN. In this case, I think perhaps, yes.

Senator EXON. I guess what you are telling us in a very nice sort of a way is that if we go ahead with this particular request from the Air Force, you are giving us advance warning to follow it closely?

Mr. CONAHAN. Yes, sir.

Senator EXON. Is that a fair statement?

Mr. CONAHAN. Yes, sir.

Senator EXON. I have no further questions. Is there anything else that you or your associates care to say before we excuse you? We woud be glad to hear it at this time. And we do appreciate your consideration and direct answers to our questions.

Mr. CONAHAN. Well, thank you for the opportunity.

Senator EXON. Thank you, very much. You are excused.

We now turn to the second scheduled witness, Hon. John E. Krings, the Director of Operational Test and Evaluation in the Pentagon.

Welcome to you, Mr. Krings.

Since you were not here at the beginning, let me just repeat for you from my opening statement what the subcommittee hopes to learn from your testimony and your answers to our questions.

I said, and I quote from my previous statement, "Instead, I have asked our witnesses to focus on the well-publicized shortcomings of the offensive and defensive ECM systems. I have asked them to give us their best assessments of how well-understood the nature and extent of the problems are, of how well-defined the course of action to fix these problems is, and of how much time and money will be required to achieve something approaching the capability that was initially envisioned for this airplane.

In sum, we need to ask for your best judgment as to whether we can fix this airplane for the $600 million, and the year-and-a-half that the Air Force claims, or whether the distinguished Chairman of the House Armed Services Committee is really closer to the mark at $3 billion more and 4 years to fix it.

Since the B–1B will sooner or later become a launch platform for the air-launched cruise missiles, there clearly is a limit to how much we should be willing to invest in the B–1 ECM fixes, and we certainly want some assurance that we can fix it before the Soviet air defenses become so robust that it cannot penetrate even if fixed.

Finally, I would ask you to comment on what lessons we have learned or should be drawn from the B–1B experience to be applied to the ATB.

With that, we are delighted to have you. I know that you have heard part of the previous testimony and the answers, and the concerns that have been expressed by the subcommittee, that by and large supported the B–1B very strongly when it came out.

And I guess as we have heard from the previous witnesses, and I think I can speak for most of my colleagues, that we are very fearful that one of the problems we have had with the B–1B program is it concerns the issue that everybody was trying to do everything in an extremely short time frame. Maybe we oversold ourselves and the public on what this airplane could do.

We, I think, are willing to bear our fair share of the responsibility for the difficulties that the program is presently in. With that, I

will simply say that I read your prepared testimony, Mr. Krings. The full part of your testimony will be inserted into the record, and you can either refer to that, as you wish, and read it in full, or if you would care to make any comments connected therewith, we would be glad to hear it.

Anyway, your statement is accepted without objection as part of the record. I would yield to you at this time.

STATEMENT OF HON. JOHN E. KRINGS, DIRECTOR OF OPERATIONAL TEST AND EVALUATION, OFFICE OF THE SECRETARY OF DEFENSE

Mr. KRINGS. Thank you very much.

I appreciate the opportunity to come to this committee and discuss the B-1 program and the problems in the future. I appreciate having my prepared statement put in the record, and I would like to just comment a little bit on the statement for a few minutes, and then go into the questions and answers, if I may.

I am glad to have this opportunity to discuss a program that is vital to our defense, the B-1B. I would like to start out by saying, even in its currently unfinished state, the B-1B is a dramatic, necessary, and overdue improvement upon the B-52.

I am an experienced experimental test pilot. I have been flying these kinds of airplanes all my life, and I have recently flown a B-1B operational test flight down at Dyess Air Force Base.

I would like to point out that the basic low-altitude flying qualities and ride qualities are exceptional. There is no question about it. The approach and handling characteristics are exceptional, and the refueling handling characteristics are exceptional.

They approximate on a 1 to 10 scale the highest numbers achieved in earlier attack and fighter airplanes. Unlike other bombers and tankers, the B-1B has tremendous flying qualities in the areas that the airplane really lives, which is low altitude/high speed. It always has to take off and land, and most of the time it has to refuel.

So those basic qualities which are very, very difficult to fix if they are wrong, are in fact resident in the airplane and were built in to start with. So I think we have to put the pluses up front as we talk about some of the minuses.

So I think when it is finished, the B-1 will have all the operational capabilities it was expected to have. I guess the question is, why have we not accomplished this up to now, and why have we not accomplished all of the testing we promised, and why did we not get things done the way we expected to?

To me, there is little technical risk in the items that have yet to be done, with the exception of the ECM system. The ECM system is a technical risk in terms of the time that is allotted for accomplishment. The other areas of concern should not present technical risks, because quite truthfully they have been solved many times over by many other people and in many other situations on other airplanes. So it is a case of finding the way to do these things in this airplane, by this particular group, as opposed to really doing something new, overcoming some new, insurmountable concern.

I guess if I were to look at why we are where we are, I would break it down into a few areas. Number one, which has been discussed over and over again, is the management deficiencies at all levels of the B–1 program. I think that we can include the Congress, the Department of Defense, the Air Force, the contractor, and everybody in this particular event.

It has not been a very well managed program. I am not certain with perfect management we would have accomplished everything, but I think that we would have clearly been farther along and more people would have been aware of the progress. Maybe they would not have changed things, but they would have been more aware of them. I think there would have been opportunities to be a little farther ahead, quite truthfully.

Second, which has been discussed over and over again, is the minimal DOD oversight of the prime contractor (the Air Force) in this particular case. There was minimal oversight. This was unique, and I think that uniqueness contributed to the position that we are in today. I will discuss what we have already done to try to overcome these difficulties.

I think the third thing was, when we went from the B–1A to the B–1B, there were certain contemporary capabilities that existed throughout the industry and throughout contemporary airplanes and airframes that were not introduced into the program at that time.

It could have been—not being a part of the system at that time I can't say for sure—it could have been the desire to stay within the cost cap, the mandated IOC and other things that did not encourage the B–1 program to take advantage of contemporary improvements that existed in other airplanes at the time the B–1B was started back up again.

That, too, is reflected in the character of the airplane today, and perhaps this is true of the lateness in some of the development.

What is required is that we see discipline. We have been trying to bring to the system independent evaluation and candid reporting of progress, especially with testing. We feel that testing is the best way to measure progress, but without having a candid and independent reporting route, the best test in the world is not very valuable.

So we have been trying to put into place—and I think quite successfully in many areas—a method to introduce this candor to test reporting. And through the efforts of the Congress in creating our organization a couple of years ago, I think it has had an effect on many programs, including the B–1.

We have been very much involved in the test reporting of the B–1.

We are really seeking to establish institutional checks and balances, not just ad hoc checks and balances, on a program-by-program basis to ensure that activities that continue in the B–1 are done in a disciplined manner, and in a well-reported manner, and the activities that go on in other programs including the ATB will be so controlled.

We did indicate in our annual reports to the Congress in 1985 and 1986 that at the mandated IOC the airplane would not achieve

its full operational capability. I think words like "limited" and "less than," words to that effect, were the words that were used.

There was little, if any, response to that, but we were truly bringing up to the leadership in the Department of Defense what these problems were on a fairly regular basis, and I think there was a change in attitude and response by the Air Force once we started to do this.

One thing we want to make certain is that the remaining B-1B development and testing is done swiftly and effectively, and it will require a commitment of support from the Congress and candor and realistic planning on the part of the Department and the Air Force.

We do not want to fool ourselves into believing how big a job this really is, and how much time it is going to take. We must ensure that progress in the program is real, and that the funding is backed by testing that really represents results.

What is required now I think is a commitment to finish B-1 development and testing to find out what we really do have, and what is reasonable and affordable to improve. I think this is our responsibility—yours and ours—to the air crew and the taxpayer. I would not want to bring a punitive result to the air crew as a result of past management.

I can assure you that we are committed to do our job in assessing B-1B testing and evaluation, and in candid reporting both to the Secretary of Defense and to the Congress on the progress of the B-1 program.

I would be more than glad to answer any questions you might have now.

[The prepared statement of Mr. Krings follows:]

PREPARED STATEMENT OF HON. JOHN E. KRINGS, DIRECTOR, OPERATIONAL TEST AND EVALUATION, DEPARTMENT OF DEFENSE

B-1B

Chairman Exon and members of the subcommittee: I am glad to have this opportunity to exchange ideas with you about the B-1B program.

Even in its currently unfinished state, the B-1B is a dramatic, necessary, and overdue improvement over the B-52. I am an experienced test pilot, and I have recently flown an operational test flight in an operational B-1B at Dyess Air Force Base, Texas. The basic low-altitude, high-speed flight; air refueling; and approach/landing flying qualities in the configuration tested were exceptional. When it is finished, the B-1B will have all the operational capabilities that it was expected to have when IOC was declared last October.

However, the fact is that the aircraft did not have all the required capabilities at IOC—and it will be some time before it does, as we reported in January 1986. Why?

The reason is not technical. There is little in the technical arena that has not been done before, and nothing presents insurmountable problems.

The B-1B is behind schedule and unfinished because of management deficiencies at all levels and spanning the life of the program, the most significantly damaging of these being its cancellation by President Carter. To begin with, the capability of a military organization—the Air Force—to serve as the prime contractor and integrator for the program was not adequately challenged at the outset. To my knowledge, no one questioned the ability of a service (as one would a contractor) to carry out such a function. It was simply assumed.

Second, there was, at best, minimal oversight of the "prime contractor" by the Department. The presumption seems to have been that the Air Force is "one of us," so the sort of oversight imposed upon private-sector contractors was not required. Development and test progress was not objectively assessed and reported by the prime contractor.

Third, when the decision was made to fulfill the requirement for a new long-range combat aircraft by updating the B-1A, the aircraft was not adequately upgraded to available technology. This was a consequence of two factors—(1) what I call "prohibited technology transfer" from outside communities and (2) undemanding users unaware of applicable technological advances. For years, the fighter community has been using technologies that could have been applied to the B-1B—but it is apparent that the fighter and bomber communities do not talk with each other. To a B-52 pilot—ignorant of what his fighter-jockey brethern have available to them—the B-1 seems to be something out of Star Wars. What more could he ask for?

Although I have been speaking specifically in terms of the B-1B program, the fact is that these problems are inherent in all service cultures and in the acquisition system as a whole. There is little evidence of cross-community communication. There is no real accountability. In the case of the B-1B, it could be said that the Air Force is responsible, but that is everyone and no one. The fundamental problem is that the acquisition system is neither incentivized nor disciplined.

As I have found to my disappointment, incentivizing a bureaucracy is well-nigh impossible. However, it is possible and rewarding to discipline a bureaucracy. In the case of the acquisition system, what is required is the discipline of independently evaluated and candidly and independently reported testing and assessments for every acquisition program, from start to finish. Such oversight through test and evaluation can serve both to keep program schedules realistic and to assure early identification, reporting, and correction of problems that lead to the sort of delays and difficulties now being experienced with the B-1B. We are seeking to establish institutional checks and balances of this kind to preclude B-1B-like repetitions in other programs. The user's requirements must be independently represented. He has no competing "B-2" to turn to.

Within the limits of my office's current scope of responsibility and level of staffing, and given the fact that the B-1B procurement decision was made before we came into existence, we have been actively working within the Department to impose some measure of discipline on this program and the acquistion system in general. We have also indicated in our Annual Reports to Congress for fiscal years 1985 and 1986 our determination that, by the mandated IOC date, the B-1B would not achieve all operational capabilities set forth in the Air Force B-1B Program Management Directive.

Remaining B-1B development and testing must be done swiftly and effectively. This will require a commitment of support from the Congress and candor and realistic planning on the part of the Department and the Air Force. We must have no illusions about the magnitude of the job ahead and the cost and time involved.

To be successful and survivable in all its intended roles, the B-1B must have all its systems proven through rigorous operational testing. We are awaiting an overdue completed and updated test plan from the Air Force for our review and approval. We have insisted that this plan reflect both test adequacy and a realistic schedule based upon real developmental progress. We will assure that the tests themselves are properly conducted and the data from them is thoroughly evaluated and candidly reported to decision makers.

What is required now is an absolute commitment to finish B-1B development and testing, correct any shortcomings, and achieve all necessary operational capabilities as expeditiously and economically as possible. This is our responsibility—yours and mine—to the aircrew and the taxpayer. I look forward to working with you and all concerned to assure that this commitment is met.

I would be pleased to address any questions you may have.

Senator EXON. Thank you very much.

I listened to your testimony, and I have had a chance to review your testimony, which has been adopted as an official part of the record.

You heard the earlier discussion in the committee, I hope, with regard to the concurrency matter. The need to get things done in a hurry was an important part of the difficulties that we are experiencing. You do agree with that?

Mr. KRINGS. Yes. I think that was a singular contributor to the position we are in right now. However, I would suggest that that does not necessarily say that we cannot or should not be concurrent in any program. It suggests that we must learn to do it better.

Concurrency as we all know is one of the most vital capabilities within our commercial sector to be successful in the world market. So it does not mean it cannot be done; it just means that it is difficult. We have to learn to do it well, and maybe some programs lend themselves better to concurrency than others.

This was an example of a less-than-successful concurrent program, but I would not want to rule out concurrency, because it has such vital rewards if it is done well.

B–1B BEHIND SCHEDULE

Senator EXON. I am looking now at your statement, Mr. Krings, and I quote therefrom. "The B–1B is behind schedule and unfinished because of the management deficiencies at all levels, and spanning the life of the program. The most significantly damaging of these being its cancellation by President Carter."

I speak as a Democrat now, but I also speak as the chairman of this subcommittee, and as an American very much concerned about the national defense of the United States. Politically you know that the administration has been beating up on Jimmy Carter for years now.

I want you, if you can, since you chose to put that statement in the record, to explain how we blame Jimmy Carter for canceling the program? Had Jimmy Carter not canceled the program, we would have built a B–1 bomber that would have been even more obsolete, I suggest, than what we have on our hands today. Is that not true?

Mr. KRINGS. Not necessarily, quite truthfully. I did not intend a political indictment. It clearly was not. But quite frankly, what we are really looking at in the B–1 is an unfinished program that is late. With the 2 years, or 1½ or 3 years, or whatever it takes to finish the B–1, clearly we are talking about time as being the most significant problem with the B–1—not necessarily its ultimate capability, but really time.

So in my view, when the program was stopped, for whatever reason—and it could have been "President Anybody"—that is the person who ultimately was responsible for canceling it.

Senator EXON. Oh, I do not think there is any question about that.

Mr. KRINGS. And the momentum that was lost in the B–1 program, and the effort to get it back going again, and people making great mistakes after that, and perhaps trying to cap it and get it out as quickly as possible, all of that contributed to it.

But right now the B–1 is behind in time more than anything else. I do not think that any of the technical problems that exist are difficult to solve. With the exception of the ECM, all the problems that exist with the B–1 are a function of time.

If you were to look at what is the most significant problem in the whole B–1 program, it is the loss of time. The airplane I think could have been out, equally as capable, sometime before now. Fortunately, nothing has happened in the meantime to require the airplane.

Senator EXON. You say the airplane could have been out. Are you saying that the B–1B is essentially the B–1, and that the B–1B

has essentially the same characteristics and would have been just as good, had we considered under B–1 when it was canceled by President Carter?

Mr. KRINGS. The most significant improvement is the reduction in radar signature. Other than that, there are not too many changes to the whole B–1 airframe.

Senator EXON. Had we gone ahead with it, with the B–1 that President Carter canceled, would we not have had an aircraft that is even worse than the B–1B today?

Mr. KRINGS. I think it is hard to judge, quite truthfully. I don't——

Senator EXON. I do not think it is hard to judge at all, but tell me why.

Mr. KRINGS. Well, with the matter of reduction of radar cross section, the question is whether or not it would have been implemented on the B–1A, or whether it was only implemented as a result of the B–1B.

I think quite truthfully that most of those improvements that we developed during that period of time and found to be so rewarding probably would have been introduced on the B–1A, had the B–1A been developed. So I do not think that only the existence of the B–1B was the reason for RCS improvement.

Senator EXON. Well, if that is true, Mr. Krings, then why did we not just go ahead and build a B–1A and forget all about the B–1B? I have visited the factory and talked to the people who are building the B–1B, and they tell me this is a far superior aircraft to the B–1A. Are they misleading me, or is it just a mistaken judgment?

Mr. KRINGS. Well, I do not think it is far superior. I think it is superior. There are many facets of the B–1A that are identical to the B–1B, the most significant improvement of which is the improvement in RCS, and it is a significant contribution. I do not want to act like it is a small thing, but it was more an emerging technology that we are taking advantage of that does not necessarily preclude it from having been done on the B–1A.

ATB

Senator EXON. Mr. Krings, do you think that it is likely that the ATB will be the last of the manned bomber programs? Will the ATB be the last of the manned bomber acquisition for the United States?

Mr. KRINGS. I do not think so. Quite truthfully, I do not know whether it should be the last one, technically, but socially it probably won't be. There are an awful lot of pilots in the world.

Senator EXON. Yes, and that is one of the problems.

Mr. KRINGS. I am one of them. But I think that there are still vital roles for manned aircraft. They are shrinking. There is no question about it. The value of the pilot in many, many activities is getting far—the net effect is getting negative in many areas. But I think there still are roles for manned aircraft.

Senator EXON. I suppose that some of that would depend on what happens with regard to going on to the Soviet Union, with regard to arms control. You said something about there being an awful lot of pilots, and my time is up.

When you said that, you reminded me of something that we have joshed friendly about for a long time. In addition to an awful lot of pilots, there are an awful lot of lawyers with whom we have to have something to do, and with that fine and stirring introduction, I call on my good friend, Senator Carl Levin. [Laughter.]

MANNED PENETRATING BOMBER

Senator LEVIN. Well, first of all, on this last question our chairman asked you, I think he asked you about a manned bomber, a manned penetrating bomber I think was what he was referring to, and your answer was manned aircraft.

Were you referring to manned aircraft? Or manned penetrating bombers?

Mr. KRINGS. Really, almost either case. I think that there is a role for the manned penetrating bomber as we see the world today. It is getting smaller and smaller. There is no question about it. There are some pluses that we just cannot get otherwise.

Senator LEVIN. Do you know whether or not the ATB is being developed in a way we can avoid some of these problems we are seeing with the B–1B?

Mr. KRINGS. Yes, I do. I do know. I am quite involved in the ATB program. We are involved in two areas to ensure that those things that some people learned in the B–1 program, and some people knew already before that, are introduced into the ATB program in terms of accountability, responsibility, control of progress, and awareness of progress, those kinds of things that should have been fundamental to the B–1 program as we look back.

We are very much involved in that. The other thing we are involved in is whatever degree of concurrency the ATB might have in anyone's judgment, we want to make certain that the equivalency in testing and progress through testing is applied in a concurrent program like it is in a traditional program. In traditional programs, we stop, we hindcast, and we see how good it was, and determine whether we should go on.

Recognizing that this is the most conservative, least-risk management progress is absolutely true, but it also involves the longest period of time. So we are trying to trade off the risk in concurrency with guarantees.

Senator LEVIN. How much time did you save on the B–1 program by the use of concurrency, roughly, in years?

Mr. KRINGS. It would be in the eyes of the measurer.

Senator LEVIN. Just give me a bottom line. What is your estimate of how many years we have saved, if any?

Mr. KRINGS. I am not certain we will save very many, quite truthfully. If you look at capability, full-strength capability, it probably will not occur a lot more quickly.

Senator LEVIN. Because of our use of concurrency.

Mr. KRINGS. That is absolutely true.

Senator LEVIN. On the repair side, first of all are you satisfied that it can be done, that we can gain the ECM capability that was described?

Mr. KRINGS. Yes, but I would also caveat the schedule.

Senator LEVIN. Putting aside the schedule, are you 95 percent confident you can correct it?

Mr. KRINGS. Yes.

Senator LEVIN. I understand it is by 1991, something like that?

Mr. KRINGS. The ECM I think will be in, at the earliest, by 1990.

Senator LEVIN. If I could add, of the same IOC as the Stealth bomber, the early 1990s I think is still the IOC for the Stealth, and it is very ironic indeed that we had our main penetrating B–1 arrive at the same time as the Stealth bomber.

Mr. KRINGS. I think that is unfair, because there is a tremendous capability with the B–1 between now and the time——

Senator LEVIN. Not as a penetrator, though.

Mr. KRINGS. Oh, yes.

Senator LEVIN. In other words, we are talking targets inside the Soviet Union despite the ECM problems?

Mr. KRINGS. Yes.

Senator LEVIN. Oh, I thought that they had changed the target.

Mr. KRINGS. No. I think in terms of penetration, and I know it is an elusive subject, but with a triad system where you have more than one weapon at your dispoal for any given targets, you obviously have more targets than you have weapons. So there are assignments that the B–1 can enjoy until it has absolute, full capability. So it is a contributor.

Senator LEVIN. Inside the Soviet Union?

Mr. KRINGS. Absolutely.

ECM DISAPPOINTMENTS

Senator LEVIN. Have there been any changes at all as a result of the disappointments on the ECM?

Mr. KRINGS. Oh, yes. I think that the target list that may have been generated 5 years ago for the B–1 is not the same target list that it has today, but since there are a lot of targets, I do not really think that it has a no-role position. It has a very vital role.

Senator LEVIN. Would it be significantly fewer targets inside the Soviet Union?

Mr. KRINGS. Different. No fewer, but different.

Senator LEVIN. In terms of numbers, there is no difference in numbers of targets?

Mr. KRINGS. No, because quite truthfully the list is so long, in the Air Force's view, the B–1 can handle targets, but maybe not identically the same ones.

Senator LEVIN. Not as protected by Soviet radar?

Mr. KRINGS. Not as difficult a target.

Senator LEVIN. More on the periphery?

Mr. KRINGS. Unfortunately——

Senator LEVIN. Undefended targets?

Mr. KRINGS. No. I would say it can clearly go against defended targets.

Senator LEVIN. But less defended.

Mr. KRINGS. That is right, but not necessarily less desirable targets.

Senator LEVIN. Do you have any idea of the cost of repair? Is that inside your baliwick?

Mr. KRINGS. I only hear what the Air Force says. I do not check on it.

Senator LEVIN. What percentage of that cost is going to be borne by the Government, roughly?

Mr. KRINGS. I am sorry?

Senator LEVIN. Putting aside the amount of it, do you know what percentage of the cost of repair is going to be borne by the Government?

Mr. KRINGS. Oh, a significant portion of it, to the best of my knowledge. Do you mean the correction or the finishing? I like to say the finishing of the program.

Senator LEVIN. Do you know what the, whether you call it the repair, correction, or finishing, to get the job done is going to cost the Government? 50 percent, 80 percent, 90 percent, of whose moneys have to be laid out to do the finishing? Will that be a Government decision?

Mr. KRINGS. To the best of my knowledge, the contract is such that the Government will bear the major burden of these costs.

Senator LEVIN. Is that a typical contract?

Mr. KRINGS. At the time it was signed, yes. I do not know that it would be typical of one today.

Senator LEVIN. May I ask one more question?

Senator EXON. Certainly. Go ahead.

Senator LEVIN. I know my time is up, but just on this subject, and then I will leave it to the former governors instead of the former lawyers.

Is that the same type of contract that is being entered into on the Stealth?

Mr. KRINGS. No.

Senator LEVIN. So that the Government's share will be a lot less on Stealth in the event this result occurs?

Mr. KRINGS. Yes.

Senator LEVIN. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator Levin.

Let me go into a few more things. How much of the previous testimony did you hear?

Mr. KRINGS. I heard quite a bit of Mr. Conahan's.

COST CAP

Senator EXON. Let me ask your view on the matter of the cost cap. Do you think that is positive or negative?

Mr. KRINGS. There is a point in the life of a program where I think it is a very positive event. But to try to do it too early I think precludes an honest assessment of what it is going to cost. I do not know in this particular program when that was established.

I am of the opinion that in this particular program, however, that there was money taken out more recently, and I guess the question is, if they do the testing as they plan and find that it is as capable as they advertise within the original cost, I think the Air Force would argue that they have a rather significant amount of money that was taken out, and if they get that back that would cover their testing.

That clearly would not cover the improvements that they suggest, but would cover the testing and hopefully the fixes to that which exists right now. But if they found additional problems, that could exceed the cap.

I think that capping a program and the concept of firm, fixed-price development is really not the way to go. Because at that point in time I think you still have too many alternatives in order to balance affordability and capability. If you lock in the cost very early, you may eliminate very, very high returns on investment just because you cannot fit it in the door no matter how valuable it is.

But at a point very soon after development when we really decide what we are really going to get and what they can really do, then I am absolutely in favor of firm, fixed price contracts from that point on and into production. It has proven to be very successful.

Senator EXON. Well, I suppose you agree with me that the only reason for cost caps has been that by and large these various services come down here and testify and put it in writing, and assure us, and all that, about what the costs are going to be for everything from advanced technology bombers to a toilet seat, and we seem to run way, way over that.

I guess it gets back to the matter of credibility as to the numbers that come out of the services and out of the Department of Defense for these programs.

I have not done research on it, but I would guess that if I did I would find that most of the programs, not all, but most of the programs that are brought up here that are authorized run considerably over cost. Part of that is inflation, but I mean speaking in very real terms I suspect that there is a modus operandi on those who are charged with the responsibility of coming up with a new weapons system that they tend to underestimate rather than to give us a realistic assessment. I guess that is the reason the cost cap came along.

You would not recommend, then, I take it, a cost cap on ATB?

Mr. KRINGS. Not unless I was absolutely sure that I had a truthful expression of what the time element really is and the ingredients in that cost cap. I think therein lies the problem.

Cost and the time are generally both optimistically exaggerated, because the system promotes that. Without a systemic change, there is not going to be an incentive or motive to try to be more candid up front as to how long it is going to take, and how many dollars it is going to take.

The lack of accountability over the length of the program does not inspire that person to be candid because he clearly often is not going to be the one there when it is overrun. I think one of the things that is going to be effective is the creation of the Under Secretary of Defense for Acquisition, and the direction that he is going, and the accountability that is being placed in that particular office.

I think that this will be a help, and there will be at least more focus on accountability and more candor in the presentations of what is in those caps so that they are really valid numbers.

We can do better. Absolutely, we can do better. There is no question in my mind at all that we can do a lot better.

Senator LEVIN. Do you agree with Mr. Conahan that the Air Force does not yet know whether it has the wherewithall to fix the ECM on the B–1B?

Mr. KRINGS. I would tend to agree with him in part. I do not think that the Air Force's explanation of how that is all going to be solved is as clear as it might be. There is still some confusion, in my view, as to the various elements of the ECM, and the DECM, and the radar and the rest—how that is really going to be resolved.

Senator EXON. What is your position, or what are you recommending to this authorizing committee regarding the requests that are before us, or will supposedly be coming before us, with regard to the fix-up on the B–1B?

Mr. KRINGS. I think it would be only fair to the air crews who are flying it and are expected to go to war with it that we continue the testing to find out what it does, and what it really can do, and to remedy those things that are within grasp—the flight control systems, and the terrain following, et cetera. With the ECM I guess I would be a little more cautious in terms of allowance to move ahead and be a little more critical of the progress. You created an organization in us to do that, and I think that we are doing that, and we are structured and we do have a plan in force to do that.

Senator EXON. What are the key items that you can think of that we should look at with regard to maintaining the safety of the crew, and things that obviously we could do, whatever the costs are, and we would have to measure that, to get some value received from this aircraft? Can you give me some specifics, and about how much money you would spend on specified items?

Mr. KRINGS. The program to finish the flight control system development, the stall inhibitor system and the stability enhancement function that will allow the airplane to fly more safely and more effectively at higher gross weights throughout the mission—I think that is an absolute requirement. It just has to happen. There is no way we can avoid that. There is no way we should avoid it. It would only be punitive to the crew if we did.

It is not a high technology difficulty at all. It is just straightforward engineering that has been done over and over again, and I would say what's needed is persistence and oversight to make sure that it is done correctly and swiftly in a proper manner.

The terrain following is in the same category. It has been done over and over again. It is vital to the success of the crews, and in my view that absolutely must be done.

The ECM is necessary but more difficult, and it should be done cautiously to ensure that there is a return on your investment.

Senator EXON. Thank you.

Senator McCain, I did not see you. We have a rollcall vote on. I will be glad to yield to you at this time for questions.

Senator MCCAIN. Thank you very much, Mr. Chairman.

I am very disturbed about this situation. I know that you already covered some of this ground, but I really believe, as you do, Mr. Chairman, that this can have an impact on the procurement of the ATB and other weapons systems.

Mr. Krings, I think you would agree with me that we have seen this many times in the past. I was around here, as was the Chairman, when the B–1B was being debated. There were many commitments made to this committee regarding, the progress of the B–1. Now we find ourselves in a very serious situation again.

I guess to start out, were Chairman Aspin's comments accurate as reported in The Washington Post? He said the Air Force "screwed it up"?

Mr. KRINGS. I think that is a little bit volatile. Maybe that is a characterization as opposed to facts. I do not think that the Air Force screwed it up, no. I do not think they screwed it up. I think that they were somewhat out of their league in trying to integrate and manage a program of this size, but as a typical and probably correct military organization, when you get a mission, you do do it the best you can. I think they did it the best they could. It is just that perhaps the task was outside the grasp of those who were assigned to it.

Senator MCCAIN. I understand that.

Mr. KRINGS. And I might add that there is now extreme caution in all the programs that exist in the Department of Defense now, large and small, and those that are being proposed. They are taking this into much greater consideration in all programs—who is the integrator, who is responsible, and who is accountable. And is he capable—not just willing, but capable. That is being done in all programs a lot more thoroughly now than it ever was done before.

Senator MCCAIN. Mr. Chairman, I would like to submit some questions for the record on the ECM.

You mentioned the fact that you had a program manager about to leave. He probably does not devote the attention to correcting things because it is not going to happen on his watch.

What can we do about that?

Mr. KRINGS. Well, we have done a major thing with respect to traditional programs, those programs that only go into production after operational test. The law that created our organization says that we must, and we do, provide the Congress and the Secretary with a report on a system's operational effectiveness before production is permitted.

Now the contractor is well aware that if it does not work operationally, he does not get to produce it. So he is very highly motivated to ensure that his system is in fact going to do what it is supposed to. And the service that is acquiring it should ensure that those tests are adequate to do that, because they do not want it to fail on test adequacy grounds.

When we look at a concurrent program, however, those specific checks and balances do not exist in the sequence. So what we are trying to do, and what we are proposing with the Air Force to come up and discuss with one of your committees up here, is a parallel to that traditional system of checks and balances in a concurrent program that gives the same independence and insight in reporting to Congress on such programs.

Senator MCCAIN. Well, another thing that disturbs me, and I know it disturbs the Chairman, is the fact that the Air Force is

still giving a very different version of what you and Chairman Aspin and what Mr. Conahan's report said.

I think it would be very helpful for the Members of this committee to speak with one voice about the problem here.

I hope that you will send them that message, because it certainly does not help your credibility if they are saying one thing, and you are saying another.

Mr. KRINGS. And I hope we are not maximizing them, either, on the other side. But I would agree with you, they continue to tend to minimize the problems. Since my second week in the office over there, this was painfully obvious, and we have been trying to send this message for quite some period of time.

Senator MCCAIN. There is a lot at stake here, not only the billions that have been invested, but also the future of the ATB, and I am sure this could spill over into the other advanced fighter bomber.

Mr. KRINGS. In the actual progress of the B–1 program, I think there is much more candor and much more awareness of the situation within the Air Force. I think sometimes the advertising is a little bit more optimistic than the real world that is trying to deal with it.

Senator MCCAIN. Thank you very much, Mr. Chairman. I appreciate you holding this hearing on this critical issue. I am afraid we have not heard the last of it.

Senator EXON. Thank you, Senator McCain.

I shudder at the fact that the Air Force's lack of being able to do what they told us they could do with this budget on the program such as the B–1B, which they want, what in the world would they do with the Midgetman missile, which is a program they do not want. I shudder at the possible consequences.

We will keep the record open for 24 hours for additional questions. If you could repond to any such questions as promptly as possible, we would appreciate it.

I just have one last question, and then we will adjourn, but feel free to make any additional comments you may want, although we should get to the Floor.

Mr. Krings, you refer in your testimony to technology that was available in the fighter community that was not applied in the update of the B–1. What specific technology do you have in mind? And what effect would the application of that technology have had on the performance, cost, and the capabilities of the B–1B? Could you be a little more specific?

Mr. KRINGS. Yes. I think that on the performance end, primarily if one looks at the cockpit design of a B–1, it is very F–111'ish, and the F–111 was certainly a precursor to the B–1.

In the areas of reliability, system reliability design, and safety precautions, if you will, a philosophy existed in other communities at that particular time, not only in design but in practice, that the B–1B did not incorporate. I believe that much of this was budgetarily controlled and time-constrained based on the mandated IOC, but even today you find in the various communities that they do not really know what other communities are doing, and they are reinventing the wheel that someone else has been building for a long time.

We are trying to do our best. Sometimes it is not welcome when you criticize and say that a problem you are working on has been solved someplace else. I think that there were opportunities in the B-1, especially in terms of pilot workload and equipment in the airplane to operate the airplane safely that were not taken advantage of.

Senator EXON. Mr. Krings, thank you very much. We appreciate your being over here and giving us your testimony this morning.

[Questions for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR STROM THURMOND

FLY BEFORE BUY

Senator THURMOND. Mr. Conahan, has your office calculated the increase in total program costs associated with a "Fly Before Buy" approach to the B-1B program? If you have, how would you weigh that cost against the problems that now confront us on the program?

Mr. CONAHAN. We have not calculated the total program cost associated with a "Fly Before Buy" approach to the B-1B program. The B-1B program office estimated a savings of $1 billion by using the concurrency approach. In testimony, the Air Force said the savings could range from $2 billion to $6 billion The B-1B program office was unable to provide any documentation to support estimated savings.

COST TO GOVERNMENT

Senator THURMOND. Mr. Conahan, will the fixes necessary to meet the specifications of the B-1B contracts cost the Government more than it would have cost to stretch the program to "Fly Before Buy"?

Mr. CONAHAN. We do not know the answer to this question. As indicated above, the estimates of costs associated with a "Fly Before Buy" approach to the B-1B program vary significantly. Also, the costs of correctng shortcomings is not final. Currently, the airframe contractor is estimating cost overruns, which, if realized, will cost the Government $400 billion. Also, the Air Force estimates costs of $400.3 million to retrofit defensive avionics threat updates and corrections of deficiencies. Finally, the Air Force has requested above $600 million to pay for the extension of the B-1B test program past it's scheduled completion in June 1986. For example, as of March 1987, only 10 percent of the ALQ-161A and 31 percent of the flying qualities testing had been completed. If continued testing reveals major deficiencies, costs will increase further.

ELECTRONIC COUNTERMEASURE PROBLEMS

Senator THURMOND. Mr. Conahan, in your testimony, you cite a figure of $400 million to fix the electronic countermeasures problems. Others have estimated that figure as high as $3 billion. How do you account for this difference?

Mr. CONAHAN. The current Air Force estimate to retrofit defensive avionics on the B-1B is $400.3 million. This cost, along with contract cost overruns and additional engineering changes, will be paid for out of management reserves and a supplemental request, if required. The Program Office is waiting until proposals are submitted and costs are better defined before requesting additional funds.

The $3 billion estimate may refer to enhancements planned for the B-1B. The bulk of the additional funds the Air Force has currently requested has always been considered outside the B-1B baseline program even though contemplated at the time this program started. The estimated cost of these and planned enhancements is $2.58 billion as detailed below.

B-1B ENHANCEMENTS

[In millions of dollars]

Enhancement	R&D	Retrofit kit	Kit installation	Totals
Currently Requested:				
ALQ-161A upgrades	130.0	0.0	0.0	130.0

B-1B ENHANCEMENTS—Continued

[In millions of dollars]

Enhancement	R&D	Retrofit kit	Kit installation	Totals
Forward-looking infrared radar	134.8	384.1	146.4	665.3
Military standard 1760	131.8	474.2	181.6	787.6
Subtotal	396.6	858.3	328.0	1,582.9
Not Yet Requested:				
Enhanced countermeasures	250.9	556.8	191.3	999.0
Total	647.5	1,415.1	519.3	2,581.9

THREAT TO B-1B

Senator THURMOND. Mr. Conahan, Mr. Aspin has suggested that the Air Force, and not the Soviet Union, is the greatest threat to the B-1B's success. What is your reaction to that statement?

Mr. CONAHAN. We do not normally comment on questions relating to threat.

INSTITUTIONAL CHECKS AND BALANCES

Senator THURMOND. Mr. Krings, you indicate that you are seeking to establish institutional checks and balances to preclude B-1B-like repetitions in other programs. Is this the case for the Advanced Technology Bomber?

Mr. KRINGS. Yes. An example of such checks and balances is recent direction from the Secretary of Defense concerning Secretarial Performance Reviews (SPRs). SPRs which address a system's capability are now to include an operational assessment. This addition will include: 1) operational capabilities (thresholds) to be demonstrated prior to planned program decision milestones as well as capabilities demonstrated to date; 2) an assessment of how well the system's demonstrated operational effectiveness and suitability satisfy user requirements; and 3) requirements to be satisfied prior to IOC declaration and projections toward mature capabilities if different from those for IOC. The Advanced Technology Bomber program is subject to this requirement.

B-1B'S PROBLEMS

Senator THURMOND. Mr. Krings, you suggest that the B-1B's problems can be traced to management at all levels spanning the life of the program. Is it your judgment that the Air Force and the DOD have corrected these deficiencies in the case of the Advance Technology Bomber?

Mr. KRINGS. It would be difficult for me to assess all management techniques to be implemented in the Advanced Technology Bomber program. However, at this stage it is clear that management of the ATB is better as compared to the B-1B program. The responsibility for development, integration, and performance of the aircraft and aircraft systems is vested in a contractor rather than the Government. The sharper focus on operational capabilities in performance reviews, as mentioned earlier, is another improved management tool. A series of production decision milestones is planned for the ATB program in lieu of the approach taken in the B-1B. In addition to stipulating required operational capabilities, the Air Force will stipulate the indicators to be used in determining progress toward achieving those capabilities. Periodic assessments by the Air Force Operational Test and Evaluation Center—the Air Force's independent operational test agency—will be key elements in production decisions.

THREAT TO B-1B

Senator THURMOND. Mr. Krings, Mr. Aspin has suggested that the Air Force, not the Soviet Union, is the greatest threat to the B-1B's success. What is your reaction to that statement?

Mr. KRINGS. I would not make that statement. I believe a difficulty has been differing perceptions or expectations regarding the B-1B. Initial Operational Capability for the B-1B was simply defined as delivery of the 15th aircraft to the Strategic

Air Command with sufficient support resources to accommodate a Single Integrated Operational Plan (SIOP) commitment and day-to-day flying requirements. Although that was attained, they did fall behind in the development and demonstration of many specific capabilities.

QUESTIONS SUBMITTED BY SENATOR JOHN MCCAIN

FUEL LEAKS

Senator MCCAIN. Mr. Conahan, the Air Force now claims that fuel leaks on the B-1 are less severe than those on old C-130s and KC-135s. Can you comment on that assertion?

Mr. CONAHAN. We do not have any information on the extent of fuel leaks on C-130 and KC-135 aircraft readily available to us.

FUTURE MILITARY PROCUREMENT

Senator MCCAIN. Mr. Conahan, what does the result of concurrency in the B-1 program tell us about future application of the concept to military procurement?

Mr. CONAHAN. Concurrency can be an effective technique to expedite the development and production of weapon systems, provided it is well planned and controlled. As we have reported in the past, when major weapon programs do not undergo sufficient test and evaluation before production, the risk of costly redesign and modification after deployment increases. We believe concurrency is well planned and controlled only when test results, critical to assuring mission performance, are available before production start-up.

HALF A BOMBER

Senator MCCAIN. Mr. Conahan, do we basically have half a bomber at the moment? Is this, in your opinion, better than having no new bomber at all until 1989 or 1990, the date when full development without deployment would have been completed?

Mr. CONAHAN. Clearly the B-1B has capability, can perform missions, and, hence, is additive to our strategic forces. The B-1B, however, has not yet demonstrated all its required capabilities. The answer to the second part of your question is highly subjective. Judgment of the mission effectiveness of any weapon system involves a wide variety of factors, only one of which is the capability of the aircraft. Determinations of the specific mission effectiveness of a strategic bomber must ultimately be made by Strategic Air Command, based on current strategic force objectives, threat and the capabilities of other U.S. nuclear forces. These determinations, and the factors that go into making them, are highly classified.

ALQ-161A

Senator MCCAIN. Mr. Krings, allegations have surfaced that the Air Force has demanded continual changes in the ALQ-161A since the system's inception, and that this continual change in certain components has retarded integration and deployment of a complete system. Can you comment on those charges?

Mr. KRINGS. I am not aware of continual changes demanded by the Air Force. There was and is a continuing requirement to be able to deal with threat changes. This requirement means that the software must be able to rapidly change, and it is designed so that can be accomplished. If done correctly, this should be no cause for system development delays.

I do understand that, as developmental testing progressed, the performance of the ALQ-161A was not consistent, and the Air Force demanded that the contractor deliver a product that would consistently meet specifications. I understand the contractor did make numerous changes in the system during attempts to obtain consistent performance and meet contract specifications. They also made changes in their management structure and other procedures to provide the required capability.

Senator MCCAIN. Mr. Krings, if that isn't the problem, what precisely is the "software immaturity" that retards deployment of the ALQ-161A?

Mr. KRINGS. Software immaturity means that the system's development, design, and implementation are not completed. There was apparently insufficient management attention to software releases. The ALQ-161A contractor has now assigned a full-time software manager and recognized software as the critical performance area. The contractor's software development process had included minimal developmental testing and checkpoints and no digital checkout facility at the Long Island

plant. This is being corrected with a dedicated digital test facility. Their revised software development process includes test requirements documents traceable to specifications, as well as independent software verification.

Their MOD 0 evaluation will include a systematic evaluation of MOD 0 hardware with block 3.1 software. After data is analyzed and any new problems are reported, the contractor will prepare an evaluation report with capability and limitations, and a utilization report with recommendations to maximize the operational utility of the fielded MOD 0 system.

MOD 1 will provide early performance improvements. The MOD 1 software (BLOCK 4) is being developed under an approach which includes a new set of software development procedures, early debugging in a digital test facility, and system-level testing and integration in the laboratory. That Block 4 software is to be compatible with both MOD 0 and MOD 1 hardware, significantly improving the MOD 0 hardware performance.

MOD 2 is a major hardware upgrade which completes the AN/ALQ-161 development effort. It is to correct currently known functional problems and incorporate the results of the MOD 0 evaluation. MOD 2 hardware will be accompanied by Block 5.0 software releases to correct any remaining software problems.

B-1

Senator McCain. Mr. Krings, can you comment on the allegations made earlier this week by Chairman Aspin regarding the B-1?

Mr. Krings. There are capabilities expected of the B-1B which have not yet been attained. Certain subsystems have not been completely developed and full capability has not been achieved. I believe the allegations by Mr. Aspin and testimony by the Air Force highlight a need to have better understanding and agreement concerning the specific operational capabilities to be provided by a system—any weapon system—and the points in time those capabilities will be attained.

B-1 DEFICIENCIES

Senator McCain. Mr. Krings, given what you know at the moment about the B-1's deficiencies, and assuming no new problems, can you guarantee to this subcommittee that the B-1 will be fully capable in 1991 within the original ceiling imposed by Congress?

Mr. Krings. While developmental testing of the aircraft has highlighted several problem areas, and action is underway to correct them, ongoing testing of the B-1B may highlight additional problems. It is anticipated that the ongoing development activities for the B-1B will result in the implementation of corrections by 1991. However, a guarantee that the aircraft will be "fully capable" would require an understanding of what is meant by "fully capable" as well as the ability to project with certainty the timing of all required engineering solutions.

HALF A BOMBER

Senator McCain. Mr. Krings. Do we basically have half a bomber at the moment? Is this, in your opinion, better than having no bomber at all until 1989 or 1990, the date when full development without deployment would have been complete.

Mr. Krings. I would not characterize it as half a bomber. We have a bomber that isn't finished. It has not yet attained all capabilities. In 1980 the Congress mandated that the Air Force deploy a multirole bomber with an Initial Operational Capability of not later than 1987. The Air Force selected an acquisition strategy to meet that mandate at the lowest cost. However, projections of the difficulty which will be experienced in engineering efforts have inherent risk. All engineering problems for the B-1B were not solved in sufficient time to provide all desired capabilities by the IOC date. We have a bomber which has many of the capabilities it was planned to and will eventually have. The Strategic Air Command has a weapon system today which has real military utility—a significant and long overdue improvement over the B-52. Given the prior decision to proceed with full aircraft production, I believe it would not be prudent to delay delivery of aircraft with partial capability while awaiting resolutions of all known problems. I believe a partial wartime capability with aircraft we have paid for would be better than delaying deployment.

Senator Exon. We are adjourned.

[Whereupon, at 10:49 a.m., the subcommittee was adjourned, subject to the call of the Chair.]

DEPARTMENT OF DEFENSE AUTHORIZATION FOR APPROPRIATIONS FOR FISCAL YEARS 1988 AND 1989

THURSDAY, APRIL 9, 1987

U.S. SENATE,
SUBCOMMITTEE ON STRATEGIC FORCES
AND NUCLEAR DETERRENCE,
COMMITTEE ON ARMED SERVICES,
Washington, DC.

STRATEGIC DEFENSE INITIATIVE [SDI]

The subcommittee met in open session, pursuant to notice, at 9:35 a.m., in room SD-G50, Dirksen Senate Office Building, Senator J. James Exon (chairman) presiding.

Present: Senators Exon, Nunn, Levin, Bingaman, Thurmond, Cohen, Wilson, and Symms.

Staff present: Robert F. Bott, William E. Hoehn, Jr., and Ronald P. Kelly, professsional staff members; Mickie J. Gordon, staff assistant.

Also present: Jeffrey B. Subko, assistant to Senator Exon; Greg Weaver, assistant to Senator Levin; Donald A. Mitchell, assistant to Senator Glenn; Leon Fuerth, assistant to Senator Gore; William J. Wight, assistant to Senator Warner; James M. Bodner, assistant to Senator Cohen; and Mark J. Albrecht, assistant to Senator Wilson.

OPENING STATEMENT OF SENATOR J. JAMES EXON, CHAIRMAN

Senator EXON. The subcommittee will please come to order.

Good morning to you, Dr. Brown. We are delighted to have you here. The Subcommittee on Strategic Forces and Nuclear Deterrence meets today for the 18th and fortunately for the time being its final time prior to the scheduled beginning of the markup.

We have covered many large and controversial subjects during this set of hearings. But possibly none more controversial than the subject of this morning's hearing, the Strategic Defense Initiative.

Since this is such an important matter in our overall defense and structure in the United States we intentionally scheduled this for the final meeting. It is going to be an important part of the markup that we hope to begin very shortly.

This morning the subcommittee will hear from a very distinguished outside witness, Dr. Harold Brown, the former Secretary of Defense and eminent nuclear physicist during his earlier career.

Dr. Brown, we want to welcome you and we look forward to receiving your testimony this morning. I would hope that you could help us with the answers to several important questions that we have to address during the upcoming markup. The first of these questions, of course, concerns the issue of early or phased deployment of the kind of defense system that has been much in the press of late.

What do you make of these proposals? Have you seen anything in the way of technical progress that would allow the initial phased development to meet the statutory test of military effectiveness and adequate survivability and cost effectiveness at the margin?

Is there too much emphasis in the SDI program on the near term capabilities? Do you understand how the SDI would or could evolve into the President's vision of a near perfect population defense from where it is today?

The second set of questions has to do with the appropriate funding levels for SDI for fiscal year 1988 and of course beyond. Our committee in our previous appearances has heard you recommend increases of 10 to 20 percent as about the right expansion rate for a large long-term research program.

Do you still think that this is about the right level? Do you think more real research could be accomplished if we were to defer some of the near-term projects like the Heavy Lift Launch Vehicle and the space-based kinetic kill vehicle and apply those funds to other more promising areas?

The third set of questions concerns the issue of the treaty compliance. This is something that we know that you have considerable expertise in.

My specific question stems from our hearing with General Abrahamson and Dr. Godwin last week, in which the issue of whether the technology embodied in the ERIS and the space-based kinetic kill vehicle is based on other physical principles, or whether it was known technology at the time of the treaty.

Since you were fully involved in the earlier space-based kinetic kill research programs, BAMBI and the like, and were also involved in the ABM Treaty negotiations, you are in a unique position to provide us with important technical insights into this issue.

We will turn now to your testimony, Dr. Brown and as a long time member of the previous administration and as one who has been here on many occasions to give us your advice and your expertise and allow us to pick your brains, I heartily welcome you this morning. Thanks for being here.

STATEMENT OF DR. HAROLD BROWN, FORMER SECRETARY OF DEFENSE

Dr. BROWN. Thank you very much, Mr. Chairman. It is always a pleasure to appear before you and your colleagues and I have a prepared statement, copies of which are being run off so that you will have one within a few minutes.

Senator EXON. All right.

Dr. BROWN. Thank you very much, Mr. Chairman. I think it probably is worth my going through my prepared statement be-

cause it does address many of the specific questions that you have raised.

I welcome the opportunity to appear before you today on the strategic defense program. Decisions taken on the purpose and nature of that program have substantial influence on U.S. national security and foreign relations. In this statement I will briefly present my views on these questions.

First, what are the possible purposes of a strategic defense against ballistic missiles and what is the likelihood of success? Second, given those answers, what is the appropriate nature of and level of funding for the development program on ballistic missile defense?

Is a plan for deployment timely now, and third, is the traditional or the broad interpretation of the treaty correct? What is the effect on the development program of the traditional interpretation?

To answer the first question, a strategic defense against ballistic missiles can have a wide spectrum of purposes. At one end is the defense of land-based ballistic missiles and command control facilities in order to enhance deterrence through the threat of retaliation by making more secure the U.S. ability to threaten whatever the Soviet leadership most values. In other words, hard point defense of retaliatory capability.

At the other end is the perfect defense of the United States and everything in it. Military forces, cities, people, and in some versions, an equally perfect defense of U.S. allies. Now that is the other end, that is the President's vision, the defense that makes nuclear weapons impotent and obsolete, the Astrodome defense.

Some purposes that lie in between those extremes in roughly increasing order of difficulty are defense of certain other military forces, defense of populations against a third country attack, defense against accidental or unauthorized launch of a few missiles, defense against a light but sophisticated attack, limiting damage from a major attack, and assuring survival of the United States, albeit in a gravely damaged state.

That last is a goal I think of considerable interest, I think unlikely to be feasible, but it is something short of a perfect defense that is still worth thinking about.

The feasibility of these goals depends on many factors, not least of which is the definition chosen for success. For most cases, including the population defenses against Soviet attack, the criteria of cost effectiveness at the margin, criterion of invulnerability of the defenses and criterion of stability seem to me appropriate.

Constraint through arms control on the numbers or quality of offensive forces is also an important factor. Estimates will vary, depending on the estimator, as to the comparative difficulty of various offensive countermeasures and defensive counter-countermeasures, as to Soviet strategy and the goals and the intensity with which they will be pursued.

My own judgment is that a comprehensive near perfect defense of population will be infeasible for decades and probably forever against an attack by many thousands of warheads.

Survival as a Nation is conceivable as a goal if arms control were to limit ballistic missile warheads to a few hundred and the de-

fense were 95 percent effective, an effectiveness which is by no means feasible with anything that we now know how to do.

At the other end a cost-effective active defense overlay of some basing modes for land-based ICBMs is probably feasible. It should be noted however that, first, ground-based anti-ballistic missiles would suffice for such a purpose. Second, the present basing modes cannot be defended cost effectively.

Third, a survivable basing mode without ballistic missile defense is feasible in combination with limitations on offensive forces. And fourth, even ground-based hard point defenses will probably excite concern about their actual or potential capabilities for population defense.

I mean certainly if the Soviets were to start deploying ground-based hard point defenses and announce that is what they were for, we would begin, and rightly, to worry that they might have significant capability to defend populations as well.

Now as to the nature of the program, my judgments about the value of these purposes and about the likelihood of their achievement lead me to believe that a robust program of research and of technology development is justified, for several reasons.

For one thing, some completely unexpected technological development that would make defense look much better is conceivable, though very unlikely. In other words, I and the majority of informed military technical opinion could be wrong.

Second, such a program is useful to deter and perhaps useful also as one response to a Soviet breakout from the ABM Treaty, should that occur. The SDI program has been a lever in negotiating, and it will be an element in concluding any treaty on strategic arms. So that is another use for the program.

Third, we should keep open an option for timely full-scale development and deployment of a ballistic missile defense overlay of ICBMs, if ballistic missiles are not limited and the United States decides that it must have an ICBM force that can survive without any warning. I am not saying that we should then deploy such a system, but we should have the option to do so, at least in terms of having done some of the necessary development.

The R&D program that follows from such an assessment of its purposes should stress the following. First, more advanced technologies—ground-based free electron lasers, space-based chemical lasers, and so forth, for multiple kill, especially in boost phase and mid-course intercept.

Second, discrimination methods, both for boost phase and for mid-course. This should include passive, active and interactive discrimination. Passive discrimination should include a broad spectrum of wavelengths. Active discrimination should include radar and optical imaging. Interactive discrimination should cover such medium term approaches as neutral particle beams and long term ones such as the X-ray laser.

Both of these issues, more advanced technologies for kill and the discrimination methods, I advocate significant emphasis on, not because I have any belief that they are likely to make ballistic missile defense in its more ambitious forms (the defense of population) feasible by the Nitze criteria, say, but because I am convinced that the less advanced technologies will not.

In other words, we know enough about them to be pretty well convinced they are not going to be able to hack it. The more advanced ones are further away. I doubt that they will work in the sense that I have described either. But if anything is going to work they are more likely to.

Third element, ground-based hard point defense systems design and component development. I have already mentioned why I think that needs to be pushed.

Fourth, research on space-based sensors of advanced design, since sensors are critical to the anti-ballistic missile problem.

And fifth, design of command-control-communications to operate the system and the accompanying software.

The management of the SDI program, it seems to me, has improved significantly during the past year, at least in terms of the technical program and of systems studies. On the other hand, policy-directed decisions appear to take even less account than before of the technical and military factors.

In my view, the idea of proceeding with development of a three-tier SDI system—space-based kinetic kill vehicles for use against missiles in the boost phase, exoatmospheric for the late mid-course phase, and high altitude and endoatmospheric weapons for the terminal phase, and a decision on deployment—within a few years, and the idea of beginning deployment of all three layers by 1993 or 1994, is unrealistic and would not lead to an effective capability.

There are some interesting experimental results on boost phase detection of missiles (something that has always been considered feasible) and there are also some useful advances in KKV technology, and there is respectable analysis of self-defense of space-based systems going on in the SDI office.

But to me the KKV architectures appear too easily countered by a reactive offense. It has been suggested that the Soviets are already committed on the design of their next generation of ICBMs and could not begin to deploy fast burn boosters by 1993.

As a result, it is sometimes said, in some studies or assertions, that a three-tier system of modest cost—modest defined as $50 billion or $100 billion or $150 billion—could intercept, say, 25 percent of the Soviet ICBMs or even 50 percent, and it is alleged that if that happens the Soviets would be denied a successful attack.

In fact, whether 25 percent or 50 percent attrition did that would depend on the nature and of the goal of the Soviet attack. Whether 25 percent or 50 percent attrition could be achieved depends upon the nature of the Soviet response in the design of their forces. The one thing I am sure of is that whatever the alleged cost the actual cost would be several times as large.

More important, I find the 1993–1994 initial deployment date very difficult to believe as feasible. Six years is the same time period as elapsed between the Reagan administration's 1981 decision to produce the B1, which had begun development in the 1970s but was modified in design after 1981, and the time of its initial deployment.

Seven years is about the same time as it will take to deploy an aircraft carrier, if the Congress appropriates the first funds for it this year. Can anyone believe that these systems are anywhere near as complex as even a first slice of an SDI system, or that a

first step SDI design is anywhere near as well defined as the B1 was in 1981 or an aircraft carrier is now, or that the SDI components are as ready as the components of those systems were at the corresponding times?

The question answers itself. If a fast burn booster is not in development in the Soviet Union it is because there is no need for it now. A U.S. decision to proceed with a space-based KKV layer would provide a strong motivation for Soviet development of fast-burn boosters, space mines and other counters. Those can be developed and deployed more easily, quickly and cheaply than the space-based KKVs.

If we went ahead with a 1993–1994 deployment of space-based KKVs, it would be imprudent for the Soviets not to proceed with those developments and deployments, and in these matters the Soviets are not imprudent.

As to the appropriate level of funding for SDI, I continue to believe that a modest growth rate on the order of 10 or 15 percent a year is justified over the next few years. Such a level of funding will provide some flexibility to explore new ideas and to carry out experiments to investigate what sensors, variously based on the surface, in the air, or in space, can do in finding and discriminating boosters, warheads and decoys at various points in their trajectory.

Both the general budgetary pressures on defense, which if anything are more severe than they were a year or two ago, and the likely inefficiency of more rapid growth from a $3 billion plus a year based, argue against more rapid increases in funding in the absence of a conviction that SDI has a fair chance of achieving a needed goal. As you will recognize, I have no such conviction.

With respect to the proper interpretation of the ABM Treaty, my own recollection is that the U.S. SALT delegation's purpose was to prevent development and testing of ABM systems and their components unless those were fixed land-based systems, while at the same time allowing development and testing of new kinds of ABM componentry, lasers, particle beams, forms of detectors other than radars, associated with the land-based ABMs, fixed land-based ABMs.

The delegation believed that the Soviets had agreed to this and that the treaty language expressed that agreement. I continue to believe so. Moreover, the treaty language, the testimony leading to the advice and consent of the Senate to its ratification and the sum total of the behavior and statements of the parties until the Reagan administration's change over the past year all support that view.

It must be said that the negotiating record is ambiguous enough to leave some room for argument as to whether the Soviets did accept the U.S. view at the time of the signature of the treaty. But even there the proponents of the narrow interpretation seem to me to have the better case.

Incidentally, or perhaps not so incidentally, as you specifically asked me to address this question, Mr. Chairman, it is hard to think of a KKV as anything but an interceptor, based on the same physical principles as one that operates from the ground.

Thus, if that particular form of space-based SDI is to be developed and tested, it seems to me that the Agreed Statement D to the

treaty is a weak justification for asserting that such action is allowed even under the broad interpretation.

It is possible to hold the view that SDI development, testing and early deployment is vital to U.S. security, indeed to U.S. survival. I do not, but if I did, I would suggest that the proper course is to exercise the supreme national interest clause, withdraw in 6 months time, and accept the responsibility for doing so.

In fact, if you are prepared to make the case that Soviet violations of the ABM Treaty have destroyed it, which again I am not, the United States does not need to wait 6 months.

How much more rapidly could SDI research and development proceed under a broad interpretation of the treaty?

Since the SDI office is still looking at alternative programs, as I understand it, any judgment by me must be tentative. However, even a narrow interpretation requires further definition, unilateral definition in the absence of Standing Consultative Commission or other bilateral consideration, further definition of component and of testing.

I would expect that a broad interpretation would allow tests to be carried out together that otherwise would probably have to be done separately. That could save some time. It would incur costs at a more rapid rate, although perhaps the total cost would be lower.

No such experiments could be carried out sensibly, as I read the statements of the SDI office, before 1989 at the earliest, though planning and some expenditures directed at and in support of such experiments might take place earlier.

But that approach, I think, misses the main point. It would be a mistake for the United States to erode the ABM Treaty, erode it perhaps decisively, by embarking on such a program, just as it would be a mistake to withdraw from the treaty.

Why? Because we don't have any basis on which to decide that an ABM deployment in space is in our national security interest. That seems to me to have been also the administration's position most of the time, at least until recently. And we can find out a great deal more about the feasibility of a space-based defense over the next few years under the traditional interpretation of the ABM Treaty.

Erosion or abrogation of the ABM Treaty will have major and I think adverse effects on relations with allies, on U.S.-Soviet relations, and quite possibly on the U.S. military position.

Let's keep the SDI a research program, do the necessary analysis and evaluations and experiments, have the necessary debate and then make a national decision in the early 1990s as to what is the appropriate stance for that decade.

Thank you very much, Mr. Chairman.

Senator EXON. Dr. Brown, thank you very much for a very well-prepared and concisely delivered statement, which is very helpful to us. I am very pleased to call upon my friend and co-worker, the Senator from South Carolina, now for any opening remarks that he might have.

Senator THURMOND. Thank you very much, Mr. Chairman. Mr. Chairman, I join you in welcoming our witness this morning. Dr. Brown is well known to this subcommittee and we are pleased to have him here.

Mr. Chairman, this may well be the last hearing this subcommittee holds before we will be making our recommendations on fiscal year 1988 and fiscal year 1989 budgets. Despite very severe time constraints you have seen to it that every major issue that the subcommittee will be addressing has received a fair hearing.

This accomplishment is all the more noteworthy in view of your time-consuming responsibilities on the Budget Committee. The record that has been established will serve us well in supporting our recommendations to our colleagues on the full committee and on the Senate floor.

You are also to be congratulated, Mr. Chairman, for maintaining the tradition of the Strategic Subcommittee to hold three times as many hearings and to hold them earlier in the morning than any other subcommittee. You are an early riser and a hard worker.

Finally, Mr. Chairman, I would like to reiterate several points regarding the SDI test program and the ABM Treaty that I have made previously.

The first is that in the end, SDI testing is not primarily a legal or constitutional question but a political one. The question before us is whether the United States should pursue the development of strategic defenses for deployment as quickly and as efficiently as possible, or should we be unilaterally bound to an interpretation of the ABM Treaty that costs us time and money.

The second point is that in the face of substantial Soviet investments in strategic defense and in Soviet negotiating position that calls for a stricter interpretation of the ABM Treaty than the so-called narrow interpretation, the Congress should not limit the President's options by legislating constraints on SDI testing or by debilitating reductions in SDI funding.

Thank you, Mr. Chairman.

Senator EXON. Thank you very much, Senator Thurmond. And those parts of your opening remarks that were highly complimentary of the Chairman are certainly appreciated and I know they were sincerely given and I appreciate that very much.

In all modesty I might say that had I given a testimonial to myself it could not have been better done. I really appreciate that.

I can almost take it as a nomination for President of the United States, which I respectfully decline.

Senator THURMOND. Well, you might think about it.

Senator EXON. Dr. Brown, some of the questions that myself and others are likely to ask you will be covered, I suspect, in one form or another in your all-encompassing and well-done prepared statement.

We do not ask these questions for redundancy, but possibly from our standpoint to get in the record answers that our colleagues, who will review this record, can look at after they have reviewed your statement, which will be printed of course, could be helpful to us.

So I hope you do not think we are being too redundant and I hope that you will understand that this is a highly important issue on which there are deep divisions within the subcommittee, the committee as a whole, and I dare say the Senate and the Congress. So kindly bear with us on that if you will.

I would like to enter now several questions, for the record submitted by Senator Glenn that we would like to have you answer. Senator Glenn is chairing a committee of his own this morning and asked me to please tell you that he wished he were here and these are important questions to him. They will be entered for your reply at your earliest possible convenience.

By the way, I should advise the members of the subcommittee for the record that Dr. Brown has to leave by 11:30 a.m. and we will accommodate him on that. We will keep the 6-minute rule in effect.

SDI WITHIN TREATY BOUNDS

Let me begin my questions with this. Several months ago there was a very interesting article by you that appeared in one of the Sunday editions of the Washington Post. I do not exactly remember the headline nor do I remember everything that was in that, but I do remember that I read it twice.

I believe the headline was something to the effect of maintaining our SDI program while remaining within the bounds of the present treaty. Is that correct?

Dr. BROWN. I do not remember the headline, because I do not write the headlines or the titles of op-ed pieces, Mr. Chairman, but it did have to do with the subject that you described. It had to do with the ability to carry out an SDI program under the traditional interpretation of the treaty, and using our willingness to do that as a way of getting a reduction in Soviet strategic offensive forces, which I think is a feasible negotiating approach.

Senator EXON. Using that article and your other statements in your testimony here this morning, then the bottom line recommendation that I get from you, as an expert outside witness, is that we should continue the research and development to the extent that it can be done under the terms of the treaty, essentially in the laboratory.

And that you believe that pursuing such a course of action would not only be wise but could carry us further down the road toward an understanding of what we likely can and cannot do with an SDI defense. Do you believe that such a course of action would be the best of all possible worlds in the interests of the United States and that proceeding too rapidly might indeed cause more trouble than we currently anticipate?

Dr. BROWN. I may have left a misimpression, Mr. Chairman. I would not confine experimentation to the laboratory. I think that some experiments could be done in space under the traditional interpretation of the treaty. The United States has been doing some of that. And I think that those have been within the scope of the ABM Treaty, the traditional interpretation of the ABM Treaty.

It is true that one Soviet position, as Senator Thurmond has suggested, has been at times that only experiments within laboratories, four walls and a roof, are allowed. I do not believe that is correct.

As I said, even under the traditional or narrow interpretation, you do have to do some definition. You have to define what a component is, you have to define what development and testing is.

I believe that some experiments can be done in space. I believe they should be done in space, because you do find out things that way that you cannot find out in a laboratory, important things, and my reading of the treaty is that that is allowed.

But I would not do development or testing of components or systems. I think we are far enough away from the need to do that so that we do not give up anything by limiting ourselves in that way for some years.

My own judgment is that we ought to proceed to try to get substantial reductions in strategic offensive forces, especially of Soviet ICBMs, that SDI is a useful lever in doing that, and we ought to use it for that purpose.

Senator EXON. I do not believe we are on different wavelengths. If I did not put the word in my question, I thought I did and intended to. I felt I think that I indicated that your position was that primarily, which was a key word in the question, that it would be in laboratory expenditures and development. Am I right in my assumption?

Dr. BROWN. Design, analysis, laboratory experiments, and some experiments in space.

Senator EXON. Now, as an early supporter of SDI, when it first came out, and in fact I joined with Senator Warner in holding a very unusual closed session of the United States Senate so that our colleagues could get a better perspective on this.

As a supporter of research and possibly some limited development within the existing treaty, I am somewhat concerned and dismayed today that we seem to have accelerated, through a reinterpretation of the terms of the ABM Treaty, SDI to the point that I believe that we may be inadvertently misleading the people of America to believe that we have reached a breakthrough. From information that this Senator has gleaned from lots of hearings and lots of investigations, I do not believe that we have.

As potentially promising as SDI is, I think it is not in the national security interest of the United States or the world to move too rapidly on it. What is your view of that position?

Dr. BROWN. I think you have expressed it very well, Mr. Chairman. I think that there are some interesting results. The SDI office has been quite generous in sharing some of their design work and some of their experimental results with me. I find some of it quite interesting.

It has not changed my view of the infeasibility of the perfect or near perfect defense for many decades and probably forever. It has encouraged me in my belief that the correct approach is to do research and technology development and that a program of the general magnitude and nature that I have described is the right one to do.

That is not the course that is being proposed lately, although it is sometimes hard to find out what the actual program is, since it appears occasionally to be adjusted to suit the audience. But in general I would agree with the approach that you described.

Senator EXON. Thank you, Dr. Brown. My time is up. Senator Thurmond?

Senator THURMOND. Dr. Brown, I am glad to see you again. We are glad to see you looking so well.

Dr. BROWN. Thank you, Senator Thurmond. I am always happy to discuss these matters with you too.

SDI PROGRAM REAL GROWTH

Senator THURMOND. What specific program adjustments underlie your recommendation of 10 to 15 percent real growth?

Dr. BROWN. I believe, Senator Thurmond, that my recommendation for a limit of 10 percent or 15 percent at most real growth is a reflection of my judgment on the overall program.

I have not made my own markup of the bill, nor do I propose to. My advice is to reorient the program, to emphasize the things that are described on page four of my testimony. Emphasize more advanced technologies for kill, discrimination methods, ground-based hard-point defense systems design, research on space-based sensors, design of command-control-communications and software.

At least several of those, the first four of those at any rate, are being deemphasized in the administration's program, as I understand it. What is being done by the administration is to emphasize things that can be done near term without sufficient regard to whether they are useful to be done.

So I would reorient the program very substantially in that direction, and my own judgment is that 10 or 15 percent real increase is enough to do what I think ought to be done.

Senator THURMOND. Dr. Brown, would you as Secretary of Defense, recommend that Congress impose testing limitations on a program that was the subject of ongoing negotiations in which the other party was insisting on limitations that were even more restrictive?

Dr. BROWN. That is a very good and a very difficult question for me, Senator Thurmond. All of my experience and my identification with past administrations urges me to say that the Congress should keep its hands off. It should not micromanage, and I generally take that attitude.

In this case I think the Congress needs to assure itself that its policy views are being observed. I am afraid that requires some sort of indication by the Congress that it wants, and intends to insist by the power of the purse if no other method, the administration to remain within the interpretation of the ABM Treaty that it itself espoused until about a year ago.

The Congress has to take some action. Whether that action should be detailed specification of the program I am not at all sure. I am reluctant to do that and I would prefer to see the Congress express a view and get the administration to concur in that view rather than to write into law what is already, in my judgment, the law of the land, namely the ABM Treaty ratified by the Senate.

But that may not suffice, in which case the Congress may have to deal with it on a line-by-line basis or write it into the authorizing legislation. I would be reluctant to see that happen, but I think that there may be no alternative.

Senator THURMOND. Dr. Brown, do you agree that a research program that is structured to support a full-scale development decision should include testing that provides the greatest possible degree of confidence in the technical feasibility of the project?

Dr. BROWN. As an abstract matter, that is correct. But I think that there is no design that I find meets the criteria that the administration has enunciated as the proper criteria for deployment. Until that is done I do not think there is anything to develop.

TESTING LIMITATIONS

Senator THURMOND. Dr. Brown, if there were no issue of ABM testing limitations, would you recommend a restructuring of SDI testing that took maximum advantage of cost and schedule efficiencies and provides the greatest degree of confidence and assessments of technical feasibility? Would you, for example, consider favorably the $1 billion estimated savings on the BSTS program?

Dr. BROWN. I would consider it favorably, Senator Thurmond, only if I had concluded that the SDI program was ripe for full-scale engineering development. Since I do not think it is, a removal of the treaty limitation would not change my view.

Senator THURMOND. Dr. Brown, have you read yourself the negotiating record?

Dr. BROWN. I participated in the negotiations, Senator Thurmond, and I have recently had the opportunity to refresh my recollection by looking at some of the memoranda. For the record, I have not reread every document in it, but at the time I did read every document in it. That is, however, 15 years ago.

Senator THURMOND. I believe my time is up, Mr. Chairman.

Senator EXON. Thank you, Senator Thurmond. Senator Levin?

Senator LEVIN. Thank you, Mr. Chairman, and welcome to you, Dr. Brown. It is good to have you back here.

ABM TREATY INTERPRETATION

First on the ABM Treaty interpretation issue, picking up from where Senator Thurmond just left off, when you said you had an opportunity to review portions of the negotiating record recently, was that the same negotiating record that we have had the opportunity to review up in S–407?

Dr. BROWN. I am not sure. I do not know what you have seen and I can only remember parts of what I have seen. But they consist of memoranda of conversation, for example.

Senator LEVIN. Can you give us just the circumstances of your review?

Dr. BROWN. No, it really was not a thorough review.

Senator LEVIN. You have not been invited in any event to review the same negotiating record which we have?

Dr. BROWN. No I have not.

Senator LEVIN. And if you were invited to, you would be willing to do that?

Dr. BROWN. I suppose I would have to say yes.

Senator LEVIN. Did Judge Sofaer or anybody else in his office ask you for your recollections or to assist them in reviewing this negotiating record prior to October of 1985?

Dr. BROWN. No.

Senator LEVIN. Have they done that since?

Dr. BROWN. No.

Senator LEVIN. Would you be willing to assist them if they asked you to go through the negotiating record with them and tell them how you reached the conclusions that you did?

Dr. BROWN. Yes. I would not be eager, but I would be willing.

TREATY'S TERMS

Senator LEVIN. I want to ask you about the treaty's terms, based on other physical principles. You have given us some of this response in your written testimony at page seven, by the way. But I just want to press you a bit on that.

Is an ABM system or component based on other physical principles just because its guidance system is different from what we had in 1972?

Dr. BROWN. Not in my judgment. Actually, moreover, what is being suggested here is not different from the guidance that was known, not only in 1972 but in 1959. My answer is no, but still less if the guidance is not different, which is I think the case.

Senator LEVIN. But if it were different even then?

Dr. BROWN. That is not a different physical principle. That is a different piece of engineering.

Senator LEVIN. Are technologies that were in use in weapons technology other than ABM systems or components in 1972, other physical principles?

Dr. BROWN. Well, in my judgment, no. I do not think that you can describe as other physical principles something that existed but just was not in use in a specific design. There were no ABM systems in place anyway at that time, so I think that really reinforces the answer.

I must say, Senator Levin, I am troubled to hear people say that other physical principles are being employed, when in fact it is not only not other physical principles but not even different engineering.

I mean, if you compare the KKV with the BAMBI system, I suppose you could say one used infra-red but this one uses IR. One used impact and this uses collision. That may deserve a Nobel Prize but not in physics, rather in perverse literature.

Senator LEVIN. Mr. Chairman, I think I will pass for this round.

Senator EXON. Senator Wilson?

Senator WILSON. Thank you very much, Mr. Chairman. Dr. Brown, I am delighted to see you again and we are grateful that, busy as you are, you have found time to come and contribute to what is a very important discussion.

First, let me say that I do not know when your testimony was available. As a result, when I inquired yesterday of the staff it was not available at that time. So I looked to the statement that you gave about 2 weeks ago to the House Appropriations Committee.

Dr. BROWN. The Senate Defense Appropriations Subcommittee, and it is similar enough, Senator Wilson, so that I think you will not have missed anything.

Senator WILSON. Thank you. You are quite correct. It was the Senate.

Let me ask you about a statement that you made in that statement to the Appropriations Committee. Speaking of the narrow in-

terpretation of the treaty you said, the delegation, meaning the U.S. delegation to SALT I, believed that the Soviets had agreed to this, to the narrow interpretation and that the treaty language expressed that agreement.

I continue to believe so, in both treaty language, ratification record and, this is a quote, the sum total of the behavior and statements of the parties, until the Reagan administration's change over the past year, all support that view. That is the view that the Soviets and the United States agreed to the narrow interpretation.

You say, I continue to believe so, and yet in 1977 you prepared and signed a memorandum to the then National Security Advisor to the President that expressed a directly contrary view.

Dr. BROWN. I would be interested to hear a direct quotation from and to see that document, Senator Wilson.

Senator WILSON. Well I would be happy to go over it with you in the secure room, S–407. It is still classified, but essentially what it said was, that it was clear to you that there were different views held by the Soviet negotiators and our own, and that there was a need for some clarification.

Dr. BROWN. Well, in my present statement, if I may, Senator Wilson, I express the same view, which is not inconsistent with what I have said. Let me see whether I can find the correct place.

Senator THURMOND. Dr. Brown, would you speak into the microphone so that we can hear you?

Dr. BROWN. However, even a narrow interpretation——

Senator LEVIN. What page are you on?

Dr. BROWN. I am now on page eight, the first full paragraph. Even a narrow interpretation requires further definition, unilateral in the absence of Standing Consultative Commission or other bilateral consideration, of component and of testing.

Now it may well be, Senator Wilson, I do not remember word for word what I wrote 10 years ago, that I said the same thing then. I do not regard that as being inconsistent with the narrow interpretation of the conclusion that we had gotten the Soviets to sign on to what we said.

SURFACE-TO-AIR MISSILES

Senator WILSON. But Dr. Brown, when you make the statement that the behavior and statements of the parties, until the Reagan administration's change over the past year all support that view, I have to remind you that in that memorandum you were expressly concerned with statements by the Soviet negotiator, Seminov, by statements that were subsequently made by the Soviets in the Standing Consultative Commission defending, in fact, their use of surface-to-air missiles as being within the treaty when deployed in an ABM mode and that is what occasioned your comment in that memorandum at the time.

Dr. BROWN. I see. That is very helpful to have that clarification, Senator Wilson, because it seems to me that that particular issue, the use of surface-to-air missiles in an ABM mode, does not go to Agreed Statement D at all. It has no relation to it.

I believe that interpretation of the treaty has to be a continuing function. I believed it in 1977, I believe it now. I believe that the

Standing Consultative Commission is an appropriate forum for that.

I believe that the possible surface-to-air missile use in an ABM mode was resolved through that mechanism, and I must deplore the current administration's lack of interest in using the Standing Consultative Commission to resolve any remaining ambiguities in the narrow interpretation of the treaty.

I am troubled that you have used, if that is all that is in that memorandum, which I have not had the benefit of seeing, the surface-to-air missile testing issue as an example of a failure of agreement on narrow versus broad interpretation.

Senator WILSON. In fairness to you, and I think in fairness to the rest of us, it would be a good idea to allow all of us to look at that. Now, it is classified. I wish it were not.

Senators Nunn and Levin and others have joined with me in urging the administration to make public and to declassify and make public, not only the negotiating record but other relevant documents, including the memoranda of some of the Standing Consultative Commission meetings.

Dr. BROWN. Well, it would be helpful at this time if you would or if you could quote a paraphrase of something that has to do with the narrow versus broad interpretation, since that is what the question related to.

Senator WILSON. All right, I think that is perfectly fair, and this is admittedly from memory because I do not have the document with me. But to paraphrase it, you expressed the concern to the National Security Advisor——

Senator EXON. Senator Wilson, I hate to interrupt you. If something is classified, are you sure that you want to go on record as paraphrasing it here?

Senator WILSON. I think that I can do so in a way that does not violate the classification, Mr. Chairman.

Senator EXON. Go ahead.

Senator WILSON. Essentially, you expressed concern that there was not agreement on the two sides, that specifically, the Soviets held different understandings and that the difference was necessarily going to cause trouble. Now that, in simplest terms, is the gist of what you expressed as a concern to the National Security Advisor.

I take that at face value, the concern that you expressed then. It seems to me that it makes clear that it was not a concern that was exhibited only by the Reagan administration in recent times. In fact, you make reference I think to a similar lack of agreement being expressed in the then chairman of the Joint Chiefs of Staff, within the same memorandum.

Dr. BROWN. Senator Wilson, I express concerns in my testimony. Again, on page eight, I say, even a narrow interpretation requires further definition.

Senator WILSON. Yes, but that is quite different.

Dr. BROWN. Clearly when some Soviets say all experiments have to be carried on within a laboratory, with four walls and a ceiling, that is a difference in interpretation. That is what the Standing Consultative Commission is for. That is quite different, it seems to me, from saying, that is one sort of difference of interpretation.

Senator WILSON. Well, is it not true, Dr. Brown, that the purpose of the Standing Consultative Commission was really to try to ascertain compliance? It was not to leave to the members of the commission the job that presumably was completed by the negotiators.

I mean, what you are saying is the Senate of the United States ratified a treaty with the understanding that they were going to leave it to the SCC to fill in the blanks. Now that is hardly responsible conduct.

Dr. BROWN. It is, it seems to me, necessary for the two sides to describe what they are doing.

Senator THURMOND. I cannot hear you, Dr. Brown.

Dr. BROWN. It seems to me that it is necessary for the two sides to describe what they are doing and to explain why it is consistent with the agreement. That is what the SCC does and that inevitably involves a degree of interpretation.

Senator WILSON. Mr. Chairman, my time has expired on this round. I would be happy if it were possible for all members of the committee and Dr. Brown, in fairness to him, so that he does not have to trust his recollection for 10 years, to see that memorandum.

Senator EXON. Thank you, Senator Wilson. Senator Bingaman?

Chairman NUNN. Mr. Chairman, could I agree with Senator Wilson on that point?

Just to interject, I think we are in a very bizarre situation because the principle purpose of the classification, as I understand it, is to prevent a chilling effect on present and future negotiators by having them realize that declassification will occur and that their memos, which are now in confidence, might be known in the future.

Senator WILSON. That has obviously no application in this situation.

Chairman NUNN. In this situation, what we have got is a group of negotiators who are now being accused, by some, of either gross negligence or perhaps intentional misleading of both the President, then President Nixon, and the Senate of the United States, which seems to me has much more of a chilling effect.

But at the same time they are not given access to the record which they helped create. Everybody is going around trying to conjure up their memory of it. The only one that has access to it is Paul Nitze.

It just seems to me that, even as an interim step, before the administration decides about declassification, they ought to let the previous negotiators who did make the record have access so that they could at least discuss it intelligently.

Senator LEVIN. If Senator Bingaman would yield just for a comment on that point, I have specifically asked the administration to do that.

Senator WILSON. We have all asked the administration.

Senator LEVIN. No, no. I think what you made reference to before is that we have all asked the administration to declassify. That is not what I am referring to.

What I am saying is I have specifically asked the administration to invite the negotiators into that S-407 room and go over the record with them and ask them to justify their conclusion which

they all reached, that the narrow interpretation was the correct interpretation.

Now that seems to me to be just absolute common sense before you even talk about declassifying, which I am all for, to confront our negotiators and ask them for some explanation and guidance here.

Now I have raised that specifically with Judge Sofaer. He told me that he would do that. That is why I pressed Dr. Brown this morning on this issue. Would he be willing to participate in that kind of an effort, and his answer was yes, after some pause. But nonetheless, yes.

Senator WILSON. I can understand why he is not enthused about taking more time.

Senator EXON. The Chair is going to have to interrupt here. We are going to run out of time.

Dr. BROWN. I would like to make one relevant observation, Mr. Chairman, since we are talking about procedure. I will make it very short.

There was a paper describing research and development, which I, as a member of the delegation, handed to the Soviets at some point in the proceedings. It was being referred to in the newspapers, and I asked the Defense Department if I could have a look at that paper, since my name was being used in connection with it.

They did not say no. I never got an answer.

Senator EXON. Senator Bingaman?

PARTIAL DEPLOYMENT

Senator BINGAMAN. Dr. Brown, let me change the subject a little bit and this may be something that you referred to in your initial comments here. Let me just quote you the sentence I am going to ask about.

You say, In your view, the idea of proceeding with development of a three-tier SDI system and deciding on deployment within a few years and beginning deployment of all three layers by 1993 or 1994 is unrealistic and would not lead to an effective capability. I would like to ask about two other aspects of that same issue.

This partial deployment or this early deployment that has been considered, I have had the distinct impression that not only might it be unrealistic and not lead to an effective capability, but it could have a destabilizing effect on our relations with the Soviets, in that we would be trying to put forth some kind of partial defense for a partial attack, partial defense against a less than total attack, and in that way perhaps create some kind of perverse incentive for nations, ourselves and the Soviets, to contemplate something other than that.

I would be interested in any thoughts you have on that issue.

Dr. BROWN. It is all very hypothetical, Senator Bingaman, because there is, in my judgment, no way to have a capability by 1993 or 1994, for reasons that I gave.

But if you look at those hypothetical situations, what can happen is if we put up a system, or begin to put up a system, and the Soviets worry that it is going to be quite effective, but much more effective when it is all put up than when it is partially put up, that is

an incentive for them to try and destroy the system. Not necessarily to launch a preemptive attack, on the United States, but to destroy the system as it goes up.

If they did, to put it mildly, that would lead to a very substantial crisis in relations and a grave risk of war. There is that degree of instability. Even if one goes beyond that and both sides have systems up or in place, say, there is perhaps a greater advantage in striking first if both sides have a defensive system than if neither side has a defensive system, since your own defensive system will operate better against a severely damaged retaliation.

So I think those are all considerations. As I say, I regard them as hypothetical. What troubles me is that they have apparently not been given a careful enough examination in what may be decisions to go to full-scale engineering development and to deployment.

Senator BINGAMAN. Another aspect of the idea of early deployment that has concerned me is the whole idea that by going to some kind of early deployment or pursuing it, even if it did not develop in this time frame, but just pursuing it and putting the funds into it that would be required, would take resources away from the research that would otherwise go forward in other technologies that might eventually be useful to us in our national security.

I think a lot of us in Congress have supported SDI funding on the theory that there are technologies here and there are research efforts going forward here that we need to maintain a leadership position on, not knowing exactly where those will lead in terms of capability militarily.

But, would we be in danger in your view of slighting some of those research efforts by virtue of an early focus on a particular program to actually deploy?

Dr. BROWN. Well, there are two levels here, Senator Bingaman. In one sense everything competes with everything else for money and there are lots of non-strategic applications of advanced technologies that are obviously going to suffer somewhat, if a lot of money goes into SDI.

That is why I applauded this committee's initiative, or rather the Armed Services Committee's initiative, to divert some money to conventional defense initiative technologies.

At a second level, within the SDI program, as I think my testimony implies, there is a risk that the more advanced technologies, which may or may not work but have a better chance of working against a reactive offense than the more quickly available ones, will be slighted and cut down in order to fund full-scale development and perhaps deployment of the more primitive existing technologies.

Indeed I think that is happening, even with the proposed $5.8 billion SDI funding, which, I would assume, is more than the Congress is actually going to fund. There has been a cutback in some of the more advanced technologies, and I think that is a mistake.

Now that is a matter of judgment, and not only of technical but of political judgment. The administration has apparently decided that it needs to react to the concerns of the enthusiasts that, lacking an early deployment, support will disappear for the program.

I think that is a political mistake. I think that, you know better than I, there is a larger number of Members of the Congress who

are willing to go along with SDI as a research and technology development program, which is how it has been described until very recently, but are much less willing to go along with deployment.

Senator BINGAMAN. Thank you very much. Thank you, Mr. Chairman.

Senator EXON. Thank you, Senator. Senator Cohen?

Chairman NUNN. Mr. Chairman, can I ask Senator Cohen to yield to me for a minute. Are you in a big hurry, because I just want to ask one question.

Dr. Brown, thank you for being here and I have greatly benefited from your testimony. I want to ask one question.

MISTAKE TO ERODE THE ABM TREATY

You say at the end of your testimony, page eight, because we do not have any basis, it would be a mistake for the United States to erode the ABM Treaty, perhaps decisively, by embarking on such a program as it would be to withdraw from a treaty, meaning the broad interpretation.

Dr. BROWN. Yes.

Chairman NUNN. Why? Because we do not have any basis to decide that an ABM deployment in space is in our national security interest?

Those who favor the broad interpretation, getting away from the legal argument, just on the programmatic argument, take the position, yes, that is correct. We do not have any way to make the judgment. But the testing that would be prohibited by the narrow interpretation is the only way we are going to be able to find out the answer to that question.

So they say we are in a catch-22. We cannot test under the broad interpretation, certain tests that we need to find out whether we indeed can deploy feasibly and whether we should abrogate. How would you address that line of reasoning?

Dr. BROWN. My judgment is that we are not far enough along to need, or indeed greatly profit by, testing and development of components or systems, and that we can do experiments to answer those questions.

I think the opposite point of view that you presented, not advocated but presented, is somewhat undermined by the knowledge that first, the assertion was made and now the SDI office is being asked to come up with a program that may or may not justify the assertion.

In other words, the assertion that you need to do this in order to answer the question of whether an SDI deployment would be in our national interest was not made on the basis of a pre-existing development and testing program that had been designed to answer that question.

Chairman NUNN. Thank you, Senator Cohen.

Senator EXON. Senator Cohen, I appreciate your yielding for a moment. But as I understand it you would like to yield to Senator Symms.

Senator Symms, you were an earlier bird here this morning and the Chair has not overlooked you. We are delighted to have you here this morning. You are not a member of this subcommittee but

since Senator Cohen has suggested we yield to you, I am in total agreement and the Chair would recognize Senator Symms.

Senator SYMMS. Thank you very much, and I will be very brief, Mr. Chairman.

RADAR AT KRASNOYARSK

I welcome you here, Dr. Brown, I am one of those that feel that the Soviets have already destroyed the ABM Treaty with the building of the radar at Krasnoyarsk.

When I see the Soviet's blatant violations of this treaty and others such as riddling our embassy in the Soviet Union with bugs, and seducing our State Department marines to do espionage against the United States, I am not concerned about chilling relations with the Soviet Union.

I find it almost illogical that we still talk about negotiating another treaty with them which we know, if history tells us anything, they will probably violate. But in view of that, you made a statement on page six that I am very fascinated about. I think it is important because I believe we are much closer to being in a position to deploy the Kinetic Kill Vehicles than is most commonly thought by the general public.

SPACE-BASED KKV

You say if a fast-burn vehicle is not in development in the Soviet Union, it is because there is no need for it now. A U.S. decision to proceed with the space-based KKV layer would provide a strong motivation for Soviet development of fast-burn boosters, space mines and other counters.

These can be developed and deployed more easily, quickly and cheaply than the space-based KKVs. The Soviets would be imprudent not to do so, but in these matters the Soviets are not imprudent. They would do it if they think it is in their best interests.

If they went to a fast-burn vehicle, do you believe they would have the capability and the technology to maintain their accuracy and MIRVing capabilities that they now enjoy with the SS-18s?

Dr. BROWN. I think that a fast-burn booster makes that more difficult because the fast-burn booster has to burn out at a low altitude, and the deployment of MIRVs from it then become more difficult because they have to go through some of the atmosphere. The same thing is true of decoys.

On the other hand you do not have to deploy your entire force as a fast-burn booster force. You only have to deploy enough to destroy the defensive system and that they could do.

Senator SYMMS. The defensive system?

Dr. BROWN. Yes.

Senator SYMMS. In other words you think they would fire a nuclear weapon into space.

Dr. BROWN. If they are about to launch a nuclear attack on the United States, the need to fire nuclear weapons into space should not deter them.

I happen to agree with you that we should not do things in order to be friendly with the Soviets. We are adversaries, we should do

what is in our interest. It is just that you and I differ about what is in our interest in this matter.

Senator SYMMS. I thank you very much. Thank you, Mr. Chairman.

Senator EXON. Thank you very much. Senator Cohen.

EARLY DEPLOYMENT OF SDI

Senator COHEN. Thank you, Mr. Chairman. Secretary Brown, it has been suggested that because of breakthroughs in technology, we should therefore move toward an early deployment of SDI.

In other words, breakthroughs have produced the option for an early deployment. I just caught the tail end of your testimony but I think you suggested that perhaps it is not technological breakthroughs but political pressure which is generating the so-called early option. Was I wrong?

Dr. BROWN. Well, I would judge that there have not been any technological breakthroughs. After all, what is being proposed as the new system, which presumably embodies the breakthroughs, has a remarkable resemblance to drawings and proposals of the years 1959 and 1960.

SPACE-BASED KINETIC KILL VEHICLE

Senator COHEN. As a matter of fact, we were discussing this last week with respect to a Space-Based Kinetic Kill Vehicle and on several occasions General Abrahamson stated that 100 ERIS missiles could be deployed because, in essence, ERIS was a traditional ABM interceptor.

Would that be your understanding too?

Dr. BROWN. Well, legally there is no problem under the narrow definition. It is a ground-based fixed system.

Senator COHEN. And what about a Space-Based Kinetic Kill Vehicle? Would that also be traditional within the definition of a traditional system?

Dr. BROWN. I think the distinction is that a space-based system is prohibited by the ABM Treaty. It also is a great deal more difficult to do. I mean, given recent occurrences in our space program, the lift capability is a difficulty.

Senator COHEN. Other than getting it there, is there a major difference in the technology as far as the Space-Based Kinetic Kill Vehicles?

Dr. BROWN. No, they are both rockets. One fired from space, one from the ground. Both of them infra-red guided and both of them aimed at impact. So the technology is rather similar.

Senator COHEN. So conceivably then the argument could be made that even under the broad interpretation, a Space-Based Kinetic Kill Vehicle would not be permitted?

Dr. BROWN. My testimony implies that it is not based on new physical principles and therefore even under the broad interpretation it is not allowed.

EFFECTIVE DEFENSE BY 1994

Senator COHEN. Could you comment about the Marshall Institute paper that concludes that a 93 percent effective defense could be deployed by 1994?

Dr. BROWN. I have looked at that paper. I have not studied it in detail. My differences with it can be summarized in about three points.

First, it grossly underestimates the cost and time. Again, my testimony suggests that this is more difficult to build than an aircraft carrier. It is more difficult and will take longer than it did to go from the 1981 decision to the first deployment of the B1s. The cost, which I guess is expressed there is about $120 billion, are likely to be $300 billion or $400 billion.

I have seen estimates made by organizations that are much better at estimating costs and have much more experience with doing that than the authors of the Marshall Institute paper. Those conclude that the cost is underestimated by a factor of about three.

The second point is that the threat that is assumed is carefully sized so as to make the defense effective. If the Soviets would cooperate in doing that, that would be a fine outcome. But like Senator Symms, I do not trust the Soviets, I do not trust them to size their offense and structure their offense so that our defense will be effective.

Under those circumstances the claimed 90 odd percent capability of the three-layer system estimated by the authors of the Marshall Institute paper shrinks to more like 10 percent or 15 percent, which makes it pretty nearly useless.

FEASIBILITY OF SDI

Senator COHEN. In your article in *Foreign Affairs,* "Is SDI Technically Feasible," you said the following:

> Estimates of the exchange ratio for a boost-phase intercept defense layer based on kinetic-energy kill range from as low as two to one adverse to the defense at the margin, (assuming unresponsive offensive threats and including sunk costs for the offense) to more realistic estimates, assuming responsive offenses, of five or ten to one. Defense suppression would probably shift the ratio in favor of the offense.

It took me several times to get through that, I must say. But I assume that what you are saying is that even if the Soviets were to employ no countermeasures, and even if the calculations are biased in favor of the defense, the space-based kinetic kill defense still fails to be cost effective at the margin?

Dr. BROWN. Yes, but not by much. That is the two-to-one figure. And the uncertainties are probably bigger than that, which is why you will get some people to come to a contrary conclusion. I think you really have to look at all the Soviet's possibilities; that reinforces the conclusion very strongly.

Senator COHEN. But that assumes no countermeasures whatsoever. Just as you had assumed with Senator Symms that the Soviets would not tailor their offensive system to accommodate our defensive system, it is unlikely that they would not also take some countermeasures.

Dr. BROWN. Indeed.

Senator COHEN. Then the cost effective——

Dr. BROWN. The ratio gets much worse than two to one.

FIVE PHASES OF SDI DEPLOYMENT

Senator COHEN. A couple of weeks ago General Abrahamson testified that there could be five phases of SDI deployment—and I see you are looking at your watch——

Dr. BROWN. No, no, no. I am not timing you, Senator Cohen.

Senator COHEN. He said the first phase of this SDI program would be about one-sixth as capable as the overall contemplated program. He testified that the first phase would be designed to "interfere with the timing" of the Soviet attack and that this would probably cost in the neighborhood of between $40 billion and $60 billion.

There would be a subsequent phase, for which no cost was given, and it would have as its mission to "interfere with the planning" of a Soviet attack. Would you have any comment about how desirable it would be to deploy a system that would be designed to interfere with the timing of the Soviet attack?

—SOVIET ATTACK

Dr. BROWN. The timing of the Soviet attack is very important if what you are trying to do is deter them on the basis that they will not be able to knock out our retaliatory capability. If we did not have a very confident retaliatory capability, and this would give it to us, by messing up their timing, it would be worth $60 billion.

The problem is that this does not add very much to that confidence. We can be confident now. For one thing they cannot launch against our bombers and our ICBMs at the same time and have them land at the same time, so that we would either be able to take off our bombers or we would be able to launch our missiles before the attack on those respective components arrived.

That is the whole purpose of the triad and of hardening missile sites and of having submarines. We therefore must consider that a breaking up of the Soviet attack, a disruption of the timing, is not worth very much. They cannot destroy our systems now.

So I would put that $60 billion, if I wanted to put it into strategic forces, into something else. So I do not think that is a very sensible way to go. On the other hand, as a rationalization for an SDI program that was launched for a very different reason, namely a perfect defense of the United States, you can understand why that rationalization is being made.

Senator COHEN. Thank you very much.

Senator EXON. Thank you, Senator Cohen. We have 25 minutes left and we have five Senators. So if we limit each of ourselves to 5 minutes, and I would ask the timekeeper to do that, we can get our questions in. And if the witness can be good enough to recognize that we are cramped for time because he has to leave in his responses, we will move on.

MIDGETMAN VERSUS RAIL-GARRISON MX

I want to go into another matter for just a moment, not scheduled, but I think you will be glad to respond. Because of the budget constraints, Dr. Brown, and given the likely choices that this com-

mittee is going to have to make between the Midgetman and the rail-garrison MX, which would you choose?

Dr. BROWN. I would punt, Mr. Chairman. I have thought about this, and I think that there is no way that a choice is going to be made during the next 18 months.

Therefore, I conclude that the thing to do is keep the MX line going, do not spend very much on the rail-garrison mobile basing, but keep that line open, and put some R&D money into engineering development of the Midgetman missile so that when we know better where we are going to come out on arms control, on defense budgets and on a strategic nuclear policy, which we will not know until 2 years from now, whoever then makes the decision will have the options.

Now, that is not a very satisfactory situation, but it is not a very satisfactory subject.

AIRCRAFT CARRIERS

Senator EXON. That is probably what we do anyway. How high a priority and would you, if you were Secretary of Defense today, place upon proceeding with two new aircraft carriers at this time?

Dr. BROWN. I hate to second guess the people with the responsibility. But since I once had that responsibility and I had to answer the question, I feel forced to answer it. My answer is I would not put in the money for those carriers, given the budgetary constraints and the other demands.

SDI DEFENSES

Senator EXON. Thank you, Dr. Brown. The question has been raised that partially effective SDI defenses might be destabilizing.

One example that is mentioned is that defenses are much more effective against small and ragged attacks, such as might occur in a retalitory response, than they are in coping with large scale, well-planned attacks such as might be expected from a surprise first strike.

If this turns out to be the case, then both sides might be more worried about first strike with defenses on both sides than without. How sure can we be that if we proceed with early deployment, the early partial deployment, we might not find ourselves in this region of concern?

Dr. BROWN. It is a concern, Mr. Chairman. I think that there is also an asymmetry.

The Soviets have more ICBMs and fewer bomber warheads than we do, and an equal ABM defense might be more useful to them than to us, because we have fewer ballistic missile warheads to try to penetrate their defenses. So that is a symmetry problem, which is in addition to the one that you have raised.

I find it a worry, but I am not sure that, if you analyze it, you can not work your way around it. My concern, as I said to Senator Bingaman, is that not enough analysis went into this before the decision and the claims were made.

There is a bigger problem with ballistic missile defense than with the offense in judging how capable something is, because it is

a much more complicated system. We know pretty well what our ballistic missiles will do, what the Soviets' ballistic missiles will do.

You have a situation with defenses where each side may overestimate the other side's defensive capability and underestimate its own. Now that could be good because it tends to improve deterrence.

On the other hand there is the point you made. A ragged attack is a lot easier to defend against and the initiative is very important, that works the other way. And in general I would say it would add to uncertainty, but not necessarily in a way that would improve deterrence.

Senator EXON. Dr. Brown, my last question will probably take more time than we can give it this morning and if you cannot answer it briefly here this morning I would appreciate you doing so for the record.

TECHNICAL PROBLEMS CONFRONTING DEVELOPMENT OF SDI

What in your judgment are the major technical problems confronting the development of the highly effective defense system envisoned in SDI? Do they lie primarily in the area of weapons, or in the area of sensors, battle management and C3I?

Dr. BROWN. It is hard to say. I will try to give a more extensive answer for the record. But fundamentally detection, identification, discrimination are the most difficult problems. If you could tell the warheads from the decoys it would be a much more even contest.

Senator EXON. Thank you, Dr. Brown. Senator Thurmond.

ABM TREATY LIMITATION INTERPRETATION

Senator THURMOND. Thank you very much, Mr. Chairman. Dr. Brown, was there any question within the Department of Defense while you were Secretary with respect to the correct interpretation of the ABM Treaty limitations?

Dr. BROWN. The question was not nearly so burning a question at that point, and I think that there may have been some variation of opinion. But I do not think it ever became a major issue and therefore I think there was a general agreement on the general nature of the limitations.

We did set up a group to make sure that we stayed within the limitations of the ABM Treaty. And we always interpreted that, that group always used the narrow interpretation.

AGREED STATEMENT D

Senator THURMOND. Dr. Brown, what view did you or those in the Department of Defense charged with treaty compliance take with regard to the intent and application of Agreed Statement D during your tenure as Secretary of Defense?

Dr. BROWN. I will give the same answer as I gave to the last question, Senator Thurmond. We set up a group to comply with, to assure compliance with the treaty and those were their ground rules.

Senator THURMOND. Did you mean to say there was unanimous agreement or was there some dissent?

Dr. BROWN. I meant to say that there was a single policy and those who did not agree accepted the policy.

Senator THURMOND. So there were some who did not agree?

Dr. BROWN. It was not a burning issue and I therefore find it hard——

Senator THURMOND. I said, did anybody disagree?

Dr. BROWN. I do not remember any disagreement.

Senator THURMOND. You do not remember?

Dr. BROWN. I do not remember any disagreement.

Senator THURMOND. I interpreted what you say to say that there was some dissent. But that it was agreed to go along.

Dr. BROWN. Let me try to answer your question precisely.

There was, if I remember correctly, some question about how you define system and how you define component. And there was a group set up in the R&D directorate to establish what we would do in terms of complying with the treaty. I am not aware of any dissent or appeal from those decisions.

You may be able to find some paper, maybe even one that got to me, that shows that, but I am not aware of that.

CANCELLATION OF BAMBI PROGRAM

Senator THURMOND. Dr. Brown, what were the reasons for your cancellation of the BAMBI program? Was it primarily based upon concerns about technical feasibility or concerns about cost effectiveness?

Dr. BROWN. The two are related, Senator Thurmond. The same considerations that I have described now applied in 1961, that it was feasible to put up a satellite into space which would launch interceptors that would home in with infra-red guidance was clear.

What it would cost and how easy it would be to defeat was also clear. The conclusion at that time was that the offense could easily overcome the system and it was therefore not in U.S. security interests to proceed.

SPACE-BASED KINETIC KILL VEHICLES

Senator THURMOND. Dr. Brown, what effect should improvements, new technologies, such as composites, and the revolution in computing technology have on today's judgments about Space-Based Kinetic Kill Vehicles, compared to judgments you made over 20 years ago?

Dr. BROWN. If technological improvements are applied only to the defense and are not allowed to the offense, that should improve the defense's position, and it might even lead to a different conclusion.

If they are applied both to the defense and to a reactive offense, then again you have to make a recalculation. I think it is too early to know for certain, but everything I have seen so far leads to the same conclusion as was made in 1961.

Senator THURMOND. Thank You.

Senator EXON. Senator Levin.

BTI/CDI INITIATIVE

Senator LEVIN. Dr. Brown, earlier you applauded the BTI/CDI initiative that Senators Nunn and Cohen and others have been so involved with. We had a hearing on this yesterday. Do you have an estimate as to how much SDI money out of this year's request you would put in a balanced technology initiative?

Dr. BROWN. Well, of course there is a lot more money in this year's request, compared with what I think SDI deserves.

Senator LEVIN. Give us proportions. For instance, you said increase it by 10 percent, I believe, and, if so, I think this year it was $3.5 billion, so that might then go up to say $4 billion or $3.9 billion. How much of that——

Dr. BROWN. I think you could easily justify taking out $300 million or $400 million and moving it into a balanced or conventional technology initiative.

GREATEST MILITARY DEFICIENCY

Senator LEVIN. What do you consider to be our greatest military deficiency? In our strategic forces and programs or in our conventional forces and programs?

Dr. BROWN. Certainly as of this moment we have more of an imbalance in conventional forces. I think that because the strategic force balance is so important, if it gets adverse enough, I think it is important to keep putting research and development funding into strategic forces.

But I think if you ask about deployed forces the problem clearly is greater with conventional forces.

STRATEGIC FORCES

Senator LEVIN. Do you think we are doing enough now in strategic forces? Putting aside what we might have to do in the future, are we doing enough now?

Dr. BROWN. I think the deployments are at a rapid enough rate.

Senator LEVIN. You mentioned R&D for MX, rail basing, and for Midgetman. If I heard you correctly, and perhaps I did not, you would keep those in R&D?

Dr. BROWN. What I would do is keep the MX line open. I would not put much money into rail-based R&D. I would put money into the development of Midgetman, and not make any deployment decisions.

MIDGETMAN

Senator LEVIN. What about full-scale engineering of Midgetman?

Dr. BROWN. I would favor going ahead with that, actually.

Senator LEVIN. And that is $2.3 billion?

Dr. BROWN. Is that all this year?

Senator LEVIN. That is all this year.

Dr. BROWN. Well, I am not sure I would go ahead at that rate.

Senator LEVIN. The issue came up this morning about access to the negotiating record by the negotiators, and I would like the chairman to at least consider requesting the administration to invite the negotiators to review that negotiating record.

And Senator Exon, I know this is not the place to make that kind of a decision, but again I have raised this issue a number of times. I have raised it with Judge Sofaer and the last time I raised it he pretty well agreed that he would extend that invitation.

But it was not done in a formal setting and I think it would give some emphasis to the importance of this if the subcommittee were to urge the administration, prior to any decision that they are going to make at the end of April or May or whenever it is made, to invite these key negotiators to review that negotiating record and to go over their conclusions about it with the administration.

So I would submit that to the Chairman just for his consideration.

Senator EXON. Let me add, without taking from your time Senator, I think it is a worthy suggestion. I think it is something though the subcommittee would have to discuss and vote on before we made a recommendation. But I for one think it is a good one.

Senator WILSON. I for three. I would join you.

Senator LEVIN. Thank you both and I am done.

Senator EXON. Senator Wilson?

Senator WILSON. Thank you, Mr. Chairman. Dr. Brown, let me just state, and this is not a question, it is a statement. I can, if we are able to get the permission of the administration, show you a document bearing your signature in which there clearly was evidence of disagreement within the Carter administration, because it makes reference to the very different belief of the then Chairman of the Joint Chiefs of Staff.

Let me ask you this question. With regard to the line of questioning that Senator Cohen was following, is it not pretty clear, in terms of the state-of-the-art interceptors that existed at the time of the treaty, we were dependent on their effectiveness as an anti-ballistic missile device upon a nuclear warhead, upon the blast effect, on heat, on radiation, because they were unable to be sufficiently precise in guidance?

Was there not the requirement for a nuclear warhead and did they all not contain, or were they not all proposed to contain a nuclear warhead?

Dr. BROWN. The ground-based systems at the time of the 1972 treaty did have nuclear warheads because they were conceived, they were believed to be more cost-effective. That does not mean that there was no possible design at that time that would have worked on a conventional warhead.

I mean, it is simply a matter of cost-effectiveness, not of physical feasibility.

Senator WILSON. Did the treaty not, in terms of defining other physical principles, make it clear and did the Soviets not make it clear that their understanding was that a system based on other physical principles was one that did not involve anything that was then in existence of then under development, then operational or under development?

Dr. BROWN. I do not understand the distinction that you have in mind, Senator Wilson.

Senator WILSON. Well the distinction is one that narrows the definition in terms of excluding things from it.

Dr. BROWN. I suppose that is an interesting legal point. Let me pursue it in legal terms.

If there was a system that was in development in 1961 and was canceled so that it was no longer in development in 1972, does that become a new physical principle if it is reinstituted in 1985? My judgment is, no it does not.

Senator WILSON. I think the Soviets have a different judgment and I think that can be demonstrated from the SCC discussions that they had.

Dr. BROWN. Well, my statement says there is some ambiguity in the negotiating record. But I doubt that the Soviets would then have maintained that something that was in development in 1961, was canceled and was then reinstituted in 1985, but not in existence in 1972, was a new physical principle.

I doubt that you will find an answer to that in the negotiating record, however.

Senator WILSON. Well is it not true that in 1978, while you were Secretary of Defense, that the Soviets formally took the position in the SCC that an ABM system consisting of a missile and launcher component, both of which were old technology, and clearly understood to be, but that were guided by a new electro-optical sensor, must be considered as being based on other physical principles and therefore subject to Agreement D?

Dr. BROWN. I do not know the answer to that question. I mean, I simply do not know the answer.

Senator WILSON. Is it your position that the emerging ABM systems, using direct impact vehicles and relying upon collision to destroy incoming RVs, are based upon other physical principles than those that would destroy those by nuclear blast?

Dr. BROWN. I do not consider that a new physical principle. I mean it does go back before the bow and arrow to the rock.

Senator WILSON. But that is not the point. What they were saying was other physical principles other than those in operation, other than those under development at the time, at the time of the treaty.

Dr. BROWN. We are really splitting legal hairs, but a blast destroys——

Senator WILSON. That is what treaties are about.

Dr. BROWN. Perhaps a blast destroys an object by the impact of air. A kinetic energy vehicle destroys it by the impact of a material object. I do not regard those as other physical principles, perhaps because I think the physical laws applied are the same.

Senator WILSON. I suspect the survivors of Hiroshima would take a very different view. They were not attacked with a bow and arrow. I really do not see how you can maintain that the use of a nuclear blast is not a different, or a technology based on other physical principles than collision.

Dr. BROWN. If I understand you correctly, different warheads constitute different systems. And I just cannot agree, especially because the physical principles involved in the Kinetic Kill Vehicle are the same as physical principles of systems that have been described and had begun development by 1961.

If what you are saying is that only what existed in 1972, not what existed in 1971 or 1970 or 1969 or any previous time, governs,

then that is I guess a possible legal interpretation, and I suspect you may be able to find some legal advisor who will support it. But I just do not regard it as reasonable.

Senator WILSON. Well, you are correct in assuming that there are any number of people that do support that.

Mr. Chairman, my time has just about expired, let me state that the reason I asked that question of Dr. Brown, with respect to the Soviet position in 1978, that a component of a system based upon other physical principles made that whole system based on other physical principles is because that is indeed the position that the Soviets took.

And it is quite relevant to the line of questioning that was pursued with General Abrahamson last week when a very different position was taken by my colleague from Michigan and others.

Senator LEVIN. Would you yield just on that point?

Senator WILSON. Yes.

Senator LEVIN. Was that relative to a question over deployment? Was that why it was raised at the SCC?

Senator WILSON. Relative to a question having to do with development and testing. Thank you, Dr. Brown.

Senator EXON. The Chairman has no further questions. Senator Levin?

Senator LEVIN. I am just wondering if Senator Wilson would yield on my time for a question because we are trying to pin down that particular issue. Was that a discussion at the SCC over a fixed land-based system?

Senator WILSON. Mobile land-based.

MOBILE LAND-BASED SYSTEM

Senator LEVIN. A mobile land-based system and he raised it relative to development and testing and not relative to a deployment discussion?

Senator WILSON. That is correct.

Senator LEVIN. Thank you. I have no further questions.

Senator EXON. Anything further, Senator Wilson?

Senator WILSON. Yes. If you have got time for one more.

Dr. BROWN. Sure.

Senator WILSON. Let me just ask about this on page two of your statement. This is the statement to the Appropriations Committee and I think in the one today as well you made a comment that criteria of cost effectiveness and vulnerability seemed to be appropriate.

In other words you are talking about the so-called Nitze criteria.

Dr. BROWN. Which I understand to be the administration's position.

Senator WILSON. Do you think that those criteria should be applied with equality to strategic offensive forces?

Dr. BROWN. Yes.

Senator WILSON. Would you believe that last year when, as reasonable a position as you have just approved, was put forth as an amendment it was defeated by the Senate? Do you find that shocking?

Dr. BROWN. Well, not every sensible thing has to be enacted into law, Senator Wilson.

Senator WILSON. The fact is, Dr. Brown, that the point on which you and I agree was not accepted and in fact was rejected with the Nitze criteria which were being applied to SDI being termed as killer criteria when they were applied to offensive forces. I take it that you do not see them as killer criteria in your proposing that they be applied to SDI. Neither do I.

Dr. BROWN. Nor do I see them as necessarily killer criteria with respect to strategic offensive forces. I mean they are not the only criteria but I think that they are reasonable criteria to ask to be met.

RESEARCH PROGRAM

Senator WILSON. Let me ask you this final question. You have made much of the fact that we should continue a research program because of the potential that it has with respect to being a significant lever to produce arms control concessions. And I quite agree with that.

But I would go futher I think perhaps than you. If you look at the experience that we have had in gaining concessions from the Soviets, even those that we hope to gain on INF, is it not true that they have been forthcoming only when in fact we have actually deployed or at least made clear the resolve that we were going to deploy?

Dr. BROWN. In that particular case the Soviets had already deployed. And if they deployed an SDI, a space-based ballistic missile interceptor system, and we wanted them to stand it down, we would not get very far without a resolve to deploy, and perhaps without even some deployment. We are not in that situation in this case.

Senator WILSON. You say we are not in that situation.

Dr. BROWN. They have not so far as I know deployed a space-based ABM system.

Senator WILSON. If you had evidence that in fact they had, you would feel differently?

Dr. BROWN. If I had convincing evidence that they had, they would have violated the ABM Treaty and we should be governed by whatever our own security interest is in that case. As a matter of fact, in the statement I say that a vigorous research and technology development program has as one justification both a hedge and a possible response, both a deterrent and a possible response.

Senator WILSON. Are you concerned about the fact that they have a demonstrated ASAT capability and we have none?

Dr. BROWN. I do not think that is quite true, Senator Wilson. I think that the F-15-launched homing vehicle is a capability. It is a rather primitive one. Theirs is also rather primitive.

I think we are actually about equivalent and neither of them is very good. Ours has some advantages. Theirs is more nearly operational, ours has more capability. Neither of those is of significant use as an ABM. In fact, no use at all in ABM. One thing you are not going to be able to do is co-orbit with a ballistic missile several times, because it does not go into orbit.

STRICT LIMITATIONS ON ASAT

I think it is a separate issue. My own judgment is that it is in our interest to keep satellite capability on both sides from being too much endangered, and therefore I would like to see strict limitations on ASAT. I do not want to have unilateral U.S. limitations.

Senator WILSON. Do you not think that is the situation that we have now?

Dr. BROWN. Since neither side has what I consider a worrisome capability, it does not bother me. I always worry when the Congress imposes unilateral limits.

Senator WILSON. Wisely so, I think. Thank you.

Senator EXON. Dr. Brown, you have been very helpful. You have been very paitent. The hour is 11:30. You are excused.

Before we formally adjourn I would yield for 30 seconds to the Senator from Michigan for a clarification.

Senator LEVIN. Mr. Chairman, the request relative to making documents available to the negotiators I think should include the SCC document and any other documents that they may have been involved in after those negotiations for the same reasons we discussed, and I would include that in my request to the Chair.

Senator EXON. We will take that under advisement and circulate a letter to the members of the subcommittee. Thank you very much. Thank you, Dr. Brown, and we are adjourned.

[Questions submitted for the hearing record with answers supplied, follow:]

QUESTIONS SUBMITTED BY SENATOR JOHN GLENN

ASTRODOME DEFENSIVE SHIELD

Senator GLENN. Do you believe that a continental, astrodome defensive shield as described by the President is technically feasible at any time in the foreseeable future?

Dr. BROWN. No.

SOVIET REACTION TO U.S. DEPLOYMENT OF STRATEGIC DEFENSE

Senator GLENN. How do you believe the Soviets will react to a U.S. deployment of either a continental or partial strategic defense system?

Dr. BROWN. Primarily with countermeasures: more ICBMs and ICBM warheads; decoys; fast-burn boosters; precursor nuclear bursts to blind sensors. Also with direct attacks on the defensive system to suppress it: space mines; ASATs, etc.

PARTIAL STRATEGIC DEFENSE DEPLOYMENT

Senator GLENN. Many advocate a partial defense shield for our missile fields and command and control centers. Do you believe that a partial strategic defense deployment would be destabilizing? Would that create a fear in the Soviets of a U.S. first-strike capability?

Dr. BROWN. It need not be destabilizing, if it were cost-effective and limited to a close-in hard point defense. Present U.S. ICBM basing modes would have to be replaced to make such a defense cost-effective. Any space-based or long-range ground-based ABM would purport to provide some nation-wide defense, much more useful against a ragged retaliatory response than against a first-strike. Such a Soviet defense would surely so appear to us.

CRITERIA NEEDED BEFORE DEPLOYMENT OF SDI

Senator GLENN. Paul Nitze, President Reagan's arms control advisor, has argued that two criteria must be met before the deployment of strategic defenses could be justified: the defense must work even in the face of direct attack on itself, *and* it must be cheaper to augment the defense than the offense (the so-called "Nitze crite-

ria"). Do you believe that both of these two criteria will be met at any time in the foreseeable future?

Dr. BROWN. Not for population defense for the foreseeable future. For defense of strategic forces, possibly early in the next century, but only if the forces are re-based.

AMERICA'S NATIONAL SECURITY

Senator GLENN. Do you believe it is in America's national security interest to adhere to the strict, traditional interpretation of the AMB Treaty? Why?

Dr. BROWN. Yes, because to do otherwise will erode and perhaps destroy the ABM Treaty. That treaty is advantageous to U.S. national security. Even if a transition to a defense-dominated strategy is decided to be in the U.S. interest, it would have to be achieved (as the Reagan administration has itself noted) cooperatively. That would take amendment to, or a new, ABM Treaty—not best achieved by abrogating the present one.

SOVIET RADAR AT KRASNOYARSK

Senator GLENN. The Soviets' construction of the Krasnoyarsk radar is cited as a possible violation of the ABM Treaty. Do you believe that there might be any credence to Soviet allegations of U.S. violations of the ABM Treaty? Do you believe that both powers have made good faith efforts to resolve their disputes with the ABM Treaty at the Standing Consultative Commission?

Dr. BROWN. This is a matter of judgment. Mine is that U.S. actions are not in violation of the ABM Treaty. I am not privy to the discussions at the SCC. There is some reason to think that the Reagan administration has not chosen to pursue the SCC channel.

COST TO DEPLOY SDI

Senator GLENN. General Abrahamson has estimated that the first phase of a layered SDI system would cost between $40–$60 billion. Given the inevitable countermeasures the Soviets would develop to overwhelm such a system and the necessary, on-going costs of constantly upgrading America's strategic defense system, how much do you estimate it would cost to deploy SDI?

Dr. BROWN. For a partial defense including space-based components, several hundred billion dollars over a period of 15–20 years. For a system aimed at protecting populations as well, from 10–20,000 Soviet warheads, including air-breathing systems, up to one trillion dollars over a period of 20–25 years.

DIRECTION AND FUNDING FOR SDI

Senator GLENN. What do you believe is the proper direction and scope of the U.S. strategic defense research program? What do you believe should be the proper level of funding for the SDI program?

Dr. BROWN. I have answered those questions in my prepared testimony.

SPIN-OFF VALUE OF SDI RESEARCH

Senator GLENN. How significant is the spin-off value of SDI research?

Dr. BROWN. To conventional military programs and to other spaced-based military programs (ASAT, space support systems), considerable—although those benefits could be achieved at much less cost by directly supporting them. To civil technology, much less, although there could well be a boost to automated software writing, advanced optics, new manufacturing methods, and other technologies.

[Whereupon, at 11:32 a.m., the subcommittee adjourned.]

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